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June 1959

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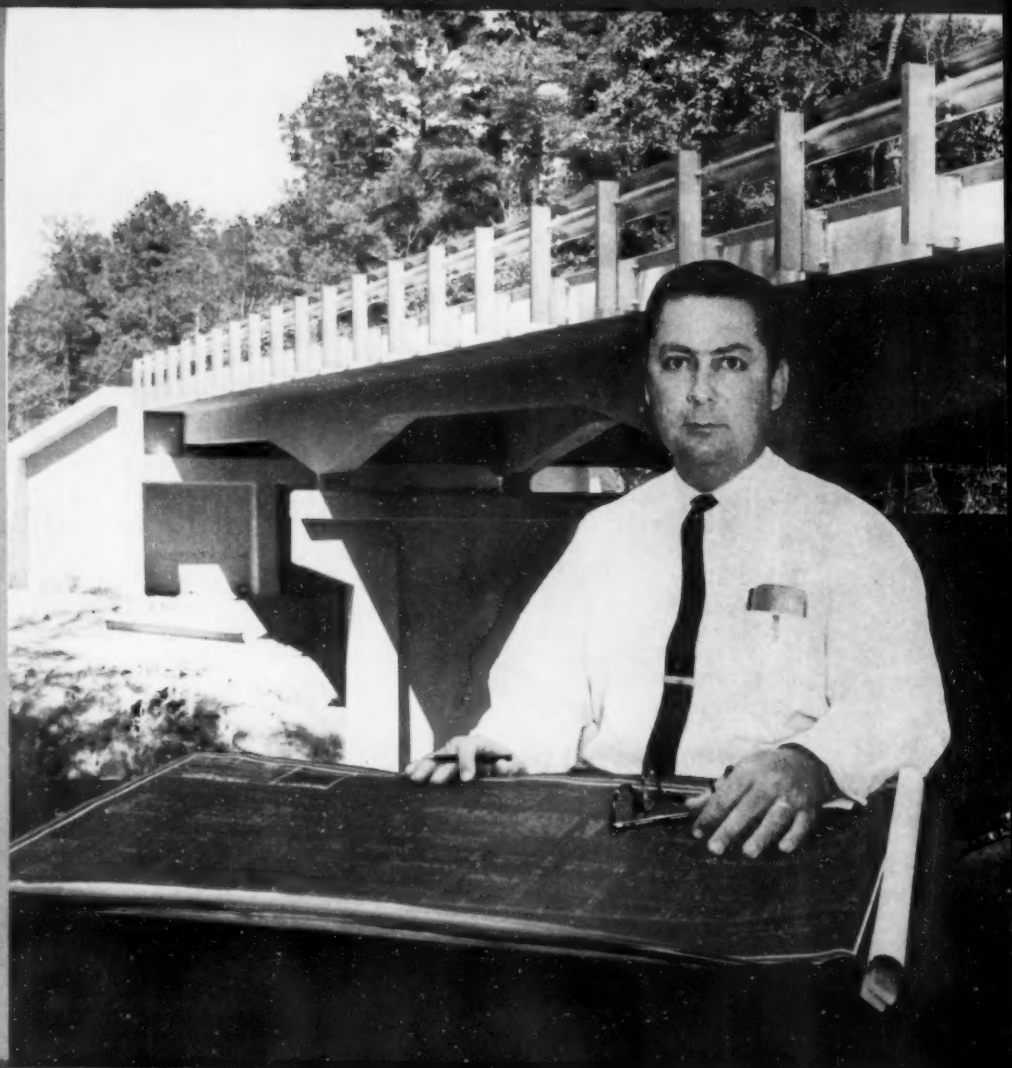

Marion Wilkins is Engineer for Conecuh County, Alabama. As such, he is responsible for many personnel, purchasing and budgeting duties, as well as for some 900 miles of county roads. More data on page 18.

Knight on a shining white Chlorinator...

I thought my days of glory were ended!

For years I charged around the countryside purifying wells with Merlin's Magic Salts. People paid me fortunes in gold and silver. Furthermore . . . sometimes my magic *worked.*

Then, suddenly, my gravy train slowed down. Wherever I travelled, I saw slick looking boxes popping up beside sick looking wells. They were every color of the rainbow. Polluted water was fast becoming a part of the past. So was I! Then, one day, I saw a stranger in the act of installing one of these weird boxes.

I ambushed him. Asked him what he thought he was doing . . . ruining an honest Knight's work. And he had the gall to tell me that he was selling Fischer & Porter Chlorinators. CHLORINATORS! I laughed and laughed. "Don't you know that chlorine is impossible to control . . . that it eats up everything in sight?" And with that I turned back to my white charger.

WHANG! Before I could mount, he pinned me to the ground with a stock model. Then he told me all about stacked diaphragm regulators, corrosion-proof materials, even built-in flowmeters. What could I do? I did the only thing possible. *I bought one.* Traded off my trusty steed for it. Whew . . . what a salesman.

So I don't have a horse anymore. And my old business is all washed up. But I don't care. I'm doing just fine charging a nickel a glass for the purest, safest drinking water in the Belgian Congo. If you're in the market, drop by. Or, get your own *safe water by writing Fischer & Porter Company, 569 Fischer Road, Hatboro, Pa. In Canada, write Fischer & Porter (Canada) Ltd., 2700 Jane Street, Toronto, Canada.*

FP FISCHER & PORTER COMPANY *Instrumentation and Chlorination*

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Chicago

HOW TO SOLVE YOUR BLOWER PROBLEM

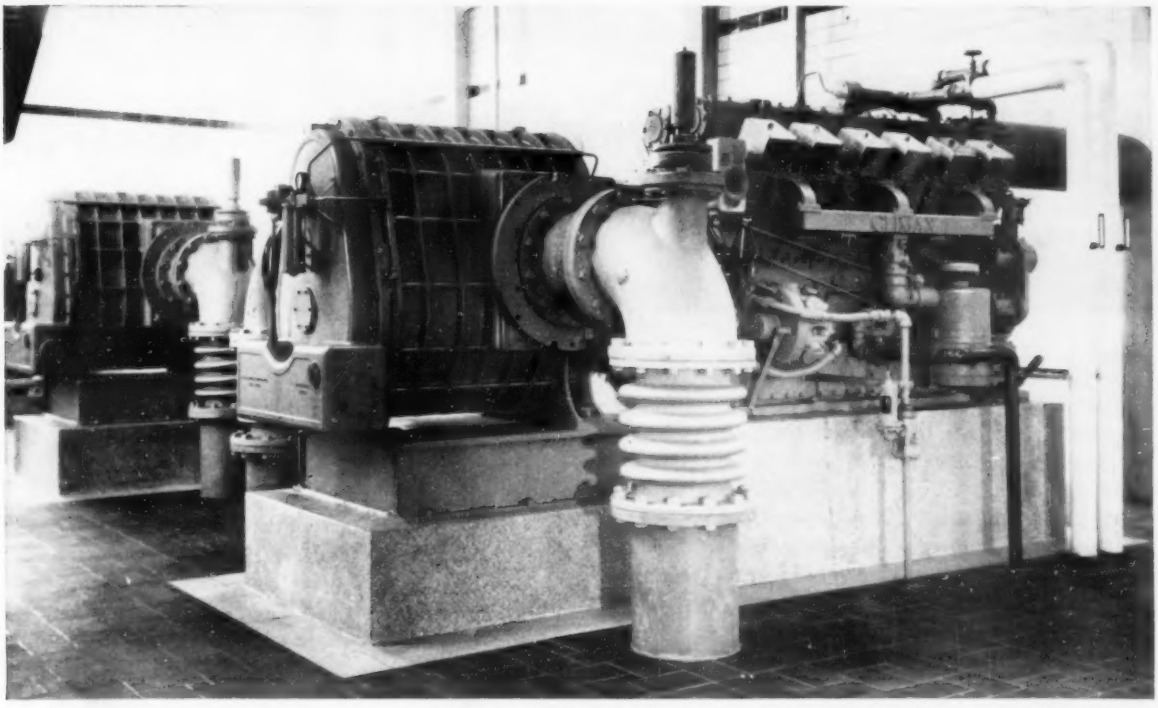
THE PROBLEM:

To obtain maximum aeration effectiveness, the delivery rate of air diffused into aeration tank liquor by individual air diffuser units *must remain as nearly constant as possible* over varying ranges of temperatures and pressures. Blowers must be compact, efficient, vibrationless, noiseless and capable of operation at high rates of speed.

THE ANSWER:

"CHICAGO" STANDARDAIRE BLOWERS

1. **Positive displacement** type of patented *axial flow* construction provides shock, pulsation-free operation.
2. **STANDARDAIRE** Blowers operate at high speed and can be advantageously direct-connected to an electric motor. Large size STANDARDAIRE Blowers operate at 1160 rpm; medium size at 1750 rpm; small size at 3500 rpm.
3. **STANDARDAIRE** Blowers provide *constant discharge* regardless of existing temperatures and pressures.
4. **STANDARDAIRE** Blowers are more compact . . . require smaller frame size motors . . . less floor space . . . smaller foundations . . . simplified piping . . . and cost less to install.



A typical "Chicago" STANDARDAIRE Blower installation at Benton Harbor, Michigan

MORE THAN 500 INSTALLATIONS

Write direct . . . or contact Chicago Pump Company Distributors in most principal cities for complete engineering data.

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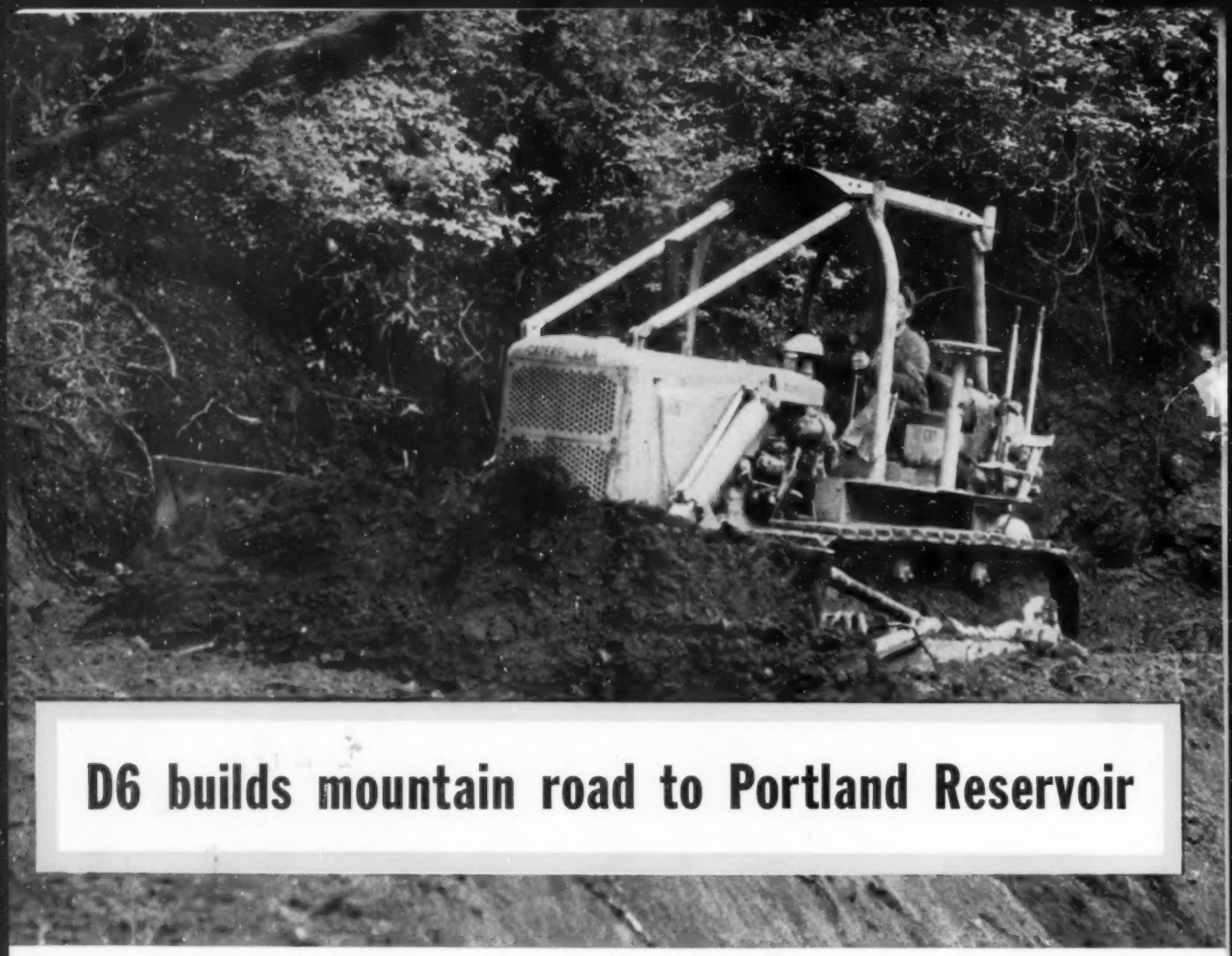

D6 builds mountain road to Portland Reservoir

Portland, Oregon, gets its supply of pure, soft mountain water from the Bull Run River . . . 30 miles east of the city. The river has its source in Bull Run Lake near the summit of the Cascades . . . elevation 3,175 feet. The uninhabited, 218-square-mile area is heavily-timbered, rugged terrain. To repair a dam at Bull Run Lake required carving out 5 miles of new road.

A Caterpillar D6 Tractor with a No. 6A Bulldozer and a Hyster donkey did the job . . . rough grading, ditching, clearing boulders, skidding logs, spreading crushed rock. All this plus general maintenance jobs such as winching logs from the lake and river.

The versatile D6 outworks any tractor in its size range. It combines high production with low operating and maintenance costs.

The 93 horsepower Caterpillar Engine delivers the push and pull to make the hard work easy; the engine's foul-proof fuel system runs on economy-type diesel fuels.

The D6 is fast . . . speeds up to 6.6 MPH . . . and easy to operate. A hydraulic unit takes the effort out of steering, helps the operator work at top efficiency.

The exclusive Caterpillar oil clutch goes up to 2,000 hours—one whole season—without adjustment. When other type clutches need *replacing*, a Caterpillar oil clutch may need an *adjustment*.

All of these factors on the D6 combine to give you maximum return on every tax dollar invested. And remember, the trade-in value on Cat machines is tops. A demonstration on your job will show you why the D6 is the work horse of so many cities, townships and counties. Call your Caterpillar Dealer soon. He'll give you the complete story. And he offers complete service, genuine parts you can trust . . . everything you need to keep your equipment in top condition.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR

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HIGH-QUALITY MACHINES WITH A LOW FINAL COST

PUBLIC WORKS

THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATES

JUNE 1959
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Established 1896

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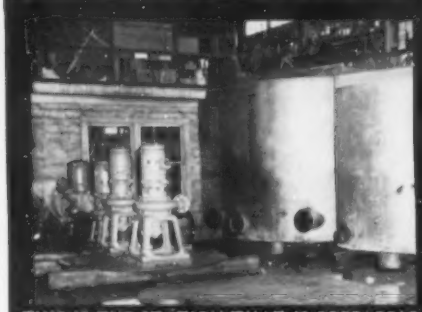
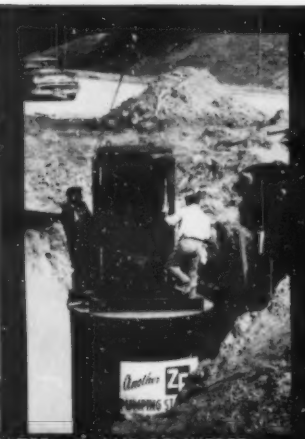
ZF PREFABRICATED PUMPING STATIONS





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TO JOB SITE . . . READY TO OPERATE

A PACKAGED UNIT—completely shop-fitted with quality components throughout. Transported to job site ready for installation.

SIMPLIFIES LOCATION—underground operation permits use of existing public property such as parkways, etc. Saves cost of surface property and enclosing structure.

ECONOMICAL—saves costs and time. Prefabrication results in lower construction costs and less time at job site. Simply set in place, connect and start up.

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the process.. AERATION, OXYGENATION
Sewage and Waste Treatment

the equipment...
WALKER PROCESS **SPARJERS**

DIFFUSAIR SPARJERS

Diffusair SPARJERS, developed by Walker Process, represent years of research and experimentation along with a continuing study of oxygenation processes. As the number of new and tube replacement installations increase, more and more Engineers and Plant Superintendents recognize that SPARJERS successfully combine controlled air bubble release with increased tank turbulence and circulation velocities to achieve an oxygenation efficiency actually superior to other types of diffusion devices. SPARJERS provide maximum oxygen absorption and include such features as CLOG-PROOF SELF CLEANING ORIFICES . . NO AIR FILTERS REQUIRED . . POSITIVELY NO BACK PRESSURE BUILD-UP . . . ECONOMICAL OPERATION.

Full-sized plant tests conducted in recent years have demonstrated the SPARJER'S superior design. In many cases they are installed on existing headers which formerly supported diffusion tubes.
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FACTORY • ENGINEERING OFFICES LABORATORIES
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POINT OF VIEW

"Nothing Will Stop Him From Trying to Save a Few Dollars"

THE ABOVE sounds like a laudable idea, and in its proper setting it would be fine. The quotation, however, refers to a contractor who is trying to save himself, not the community, this money; and it involves the use of a cheaper and substitute material for the material specified. The only way that the community can be protected against such a chiseling of quality is for the consulting or local engineer responsible to require that any saving involving quality be refunded to the community.

On public works no contractor or material man has any right to a profit through substituting a cheaper and lower grade item for that specified. The responsibility for preventing this rests squarely on the engineer. Many consultants and some cities have a policy which protects the community they represent. If everyone were equally careful, public works and the communities served by them would benefit greatly.

Looking Ahead to the Hurricane Season and Getting Ready For It

THE HURRICANE season usually ranges from July to October and right now is the time to prepare for whatever may come. Civil Defense is interested and can be very helpful, but the Public Works director has a responsibility that he cannot avoid nor pass on to anyone else. No doubt there is a pretty good inventory of large equipment available for emergency needs, but how about pumps, floodlights, chain saws and the other small tools so necessary to clear trees and similar debris from streets? Have these been inventoried; and, if there aren't enough, have arrangements been made to buy or loan what may reasonably be needed?

Bearing in mind that big-river floods are spectacular and get wide publicity, but that brook and small river floods do more damage and probably kill more people, a survey should be made to see what is going to happen to people living in the local flood plains. Then the question is what can be done to help them and who is going to do it; and will this help be preventive or will it consist of rescue operations?

In any event, a study of your potentials for hurricanes—and other natural disasters, too—cannot do any hurt and might do a lot of good. There are a good many smart folks in the employ of our cities and they could do a surprising lot if they got started.

Water Consumption Could Be Astronomical

IF MAMA gets in the habit of watering the lawn while Papa is working in his air-conditioned office, short-time water use rates can become very high. Using an inch of water a week on a 3,000-sq. ft. lawn means 275 gpd or 75 gallons per person per day for the average family. This is 5 gallons per minute for nearly an hour. Water cooled air conditioning units use about 2 gpm per ton. For a 3-ton unit the rate is 6 gpm. One such unit may care for several persons, but the combination of lawn sprinkling, air conditioning and other uses which we now call normal can produce momentary demand rates that could be painful for a water works superintendent with a utility already close to the limit of capacity. Here is a field where engineering education can be improved. In the meantime, perhaps the educational program currently being carried on by the AWWA can fill the gap and help with these vitally needed projects.

Labor Costs and Overage Equipment

OVERAGE EQUIPMENT, unfortunately, is altogether too conspicuous by its presence in the fleets of our cities and counties. Looking over the equipment lists presented in annual reports reveals a shocking number of motor graders, trucks, tractors and other basic equipment that are from ten to fifteen years old. No one makes money operating that kind of equipment.

There are two factors. One is the loss of time when one of these venerable units breaks down; with present day wage scales when three or four men lose a few hours each, costs mount horribly. The other is the greater efficiency of modern equipment. For instance, the motor grader of to-day will do 25 to 30 percent more work than a vintage of 1945 or 1950. Fuel, tires and operator time are no higher; repairs are less.

Not many communities are rich enough to afford financially overage, outmoded and inefficient equipment; nor can they afford these days the longer time it takes to do the job.

"Our Ford F-800's, pulling 20-ton payloads, give us mighty good service!"

says R. Dillard Teer, Vice President
Nello L. Teer Co., Durham, N. Carolina

"We operate about 115 Ford Trucks ranging in size from ½-ton pickups to Tilt Cab Tandem tractors. We believe in carefully fitting the truck to the job to be done and usually stay within the manufacturer's recommended ratings. We make an exception to this rule with our Ford F-800's, pulling 20-ton loads in aluminum trailer dumps to our quarry and crushing setup at Durham, North Carolina. These units are carrying the maximum legal limit and give us mighty good service!

"We haven't traded any trucks in about 6 years. It just happens that our company has been growing so rapidly that when we buy a new truck, usually an F-800, I put it under one of our trailer dumps. Then I'll take the old truck, lengthen the chassis, and make a grease outfit or a water wagon out of it. I would say out of over a hundred Ford units in the past 7 or 8 years, we have gotten rid of only a dozen altogether—and some of these were wrecked or burned.

"Another reason we use Fords is that this business is rough on trucks, so parts availability is very important. Our experience over the years with Ford as compared to Ford competitors has been definitely in favor of Ford on parts."

NOW! CERTIFIED PROOF!

FORD TRUCKS COST LESS

'59 Ford Pickups beat average mileage of other leading makes by 25.2% in Economy Showdown U.S.A.

Here at last is certified proof of the differences in gas mileage between six-cylinder pickups . . . evidence that you can use in your operation.

It was compiled by America's foremost independent automotive research firm after testing 1959 six-cylinder, ½-ton pickups of the six leading makes. All trucks were bought from dealers—just as you would.

The tests paralleled every kind of driving—high speeds and low, open highways and city traffic, even door-to-door delivery. And in every test, '59 Ford Sixes delivered more miles per gallon than any other make. Here are the actual percentages:

'59 FORD PICKUP SIXES GAVE

42.6% better mileage than make "D"
31.1% better mileage than make "I"
25.2% better mileage than make "C"
22.0% better mileage than make "S"
9.6% better mileage than make "G"

Taken together, Ford got 25.2% more miles per gallon than the average of all other leading pickups!

What's the secret of Ford's economy? First, of all pickup sixes, only the Ford Six has modern Short Stroke design which reduces friction and requires less fuel. Second, to this modern engine, Ford has added a new economy carburetor to meter fuel more precisely in both high- and low-speed ranges.

See your Ford Dealer for the full report of Economy Showdown U.S.A. and get the whole story firsthand.

All tests conducted and results
CERTIFIED
by America's foremost independent automotive research organization*
***NAME AVAILABLE ON REQUEST**
Send inquiry to P.O. Box 2687, Ford Division
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Now! During Dividend Days at your Ford Dealer's...Go *FORD*-ward for Savings

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Urges local support for better water systems

CAST IRON PIPE RESEARCH ASSOCIATION OFFERS LOCAL PLAN-OF-ACTION BOOKLET

Here's help for you and everyone else directly concerned with the supply, treatment and distribution of water—help that will acquaint the people in your town with the vital importance of this growing problem.

On the opposite page you see the second in a series of advertisements, this one appearing in April *Reader's Digest*. Placed by the Cast Iron Pipe Research Association, these striking advertisements point out to Mr. and Mrs. America how much we depend on a good water system and why we can no longer take it for granted.

Similar advertising will appear regularly in *U. S. News & World Report, Nation's Business, Better Homes & Gardens, American Home* and *Sunset* magazines to carry this public service message to millions of civic leaders and homeowners.

FREE LOCAL HOW-TO-HELP BOOKLET

These ads offer a free booklet telling about the water problem. It shows how responsible citizens can acquaint themselves with the needs of their community. It also gives a step-by-step outline of action, telling how they can help their officials extend and improve the local water system through more adequate rate structures or financing.

Let us send you a free copy of this new booklet. Write to Thos F. Wolfe, Managing Director, Cast Iron Pipe Research Association, 3440 Prudential Plaza, Chicago 1, Ill.

THREE REASONS WHY CAST IRON PIPE IS *AMERICA'S GREATEST WATER CARRIER:*

1. More miles of underground cast iron water mains are now in use than of all other kinds of pipe combined.
2. More miles of cast iron water mains are now being purchased and laid than of any other kind of pipe.
3. Impartial surveys prove that today's consulting engineers and water utility officials prefer cast iron pipe for underground water distribution by an overwhelming majority.

CAST IRON PIPE

Reader's

Oh, what will you do without water?

You mean there's a shortage?
Indeed there is. In the last five years over 1000 U. S. communities have had to ration water. It's growing less plentiful all the time.
Will *you* run dry? It depends on you.

Now, what can you do about water?

This free booklet, "*WATER—make sure you'll always have plenty,*" tells how to learn if you're running short, what to do if you are. Write Cast Iron Pipe Research Assn., Prudential Plaza, Chicago 1, Ill.

Printed in your interest by the makers of America's greatest water carrier . . .

CAST IRON PIPE

Use VITRIFIED CLAY UNDERDRAINS in your Trickling Filters and

PERMANENCE

Since a Trickling Filter can be no better than its underdrain system, it is vital that the floor blocks be of vitrified clay. They guarantee performance with protection against acids, alkalis and bacterial action that floors made from substitute materials cannot possibly give.

The 50-Year Guarantee shown here is an assurance that cannot be had from makers of any material but vitrified clay. It means that you can specify and use TFFI vitrified clay blocks with confidence — confidence that no filter bottom will have to be torn out for replacement a few years later because of failures.

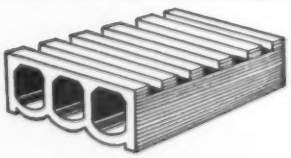
MADE ONLY IN MODERN PLANTS

A further protection to engineers specifying vitrified clay underdrains is that these blocks are made only in modern plants under controls mechanically impossible with any substitute.

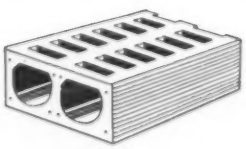
50 YEAR GUARANTEE

GUARANTEE
OF VITRIFIED CLAY PIPE & FITTINGS
FIFTY YEARS

TFFI TRICKLING FILTER



TRANSLOT
Texas Vitrified Pipe Co.
Mineral Wells, Texas



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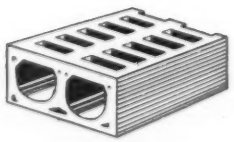

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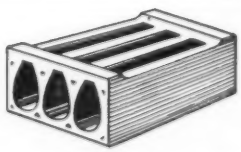
Bowerston Shale Co.
Bowerston, Ohio



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Leaders in ending stream pollution

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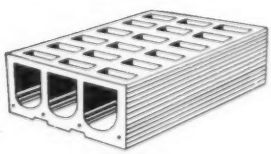
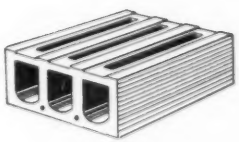
ASTM specifications insure good trickling filter underdrains —insure that you get the best. Ask any member listed below for a copy of approved Specification ASTM C-159-55.

Address any member of the Institute for full details and suggested specifications for blocks.

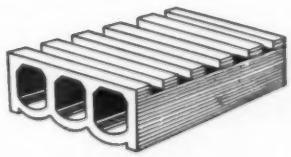
FLOOR INSTITUTE



DICKEY
W. S. Dickey Clay Mfg. Co.
Kansas City 6, Mo.



POMONA
Pomona Terra-Cotta Co.
Pomona, No. Car.



TRANSLOT
Cannelton Sewer Pipe Co.
Cannelton, Ind.

New **Butlerib**™ *panels* create the* **BOLD AND BEAUTIFUL LOOK** *for* **Butler buildings**

Take a look at the new Butlerib panels being installed at the right. Notice the unique pattern. A combination of deep and shallow corrugations creates dramatic shadow lines . . . a new sculptured look. Butlerib gives industrial and commercial buildings a new, distinctive appearance. It is the new standard cover for Butler buildings – the fastest, lowest-cost way to build well.

New Butlerib panels make the Butler system of building an even better, faster way to build well. Butler pre-engineering saves countless hours of routine engineering. Butler mass-production eliminates costly custom fabrication. Precision roll-formed, new Butlerib panels fit the Butler structural system to a "T", permit fast, bolt-together assembly methods that save you weeks – even months – of costly construction time . . . put you in business and earning profits that much sooner.

Get full details on Butler buildings and new Butlerib panels from your nearby Butler Builder. Ask him about Butler financing, too. He's listed in the Yellow Pages under "Buildings" or "Steel Buildings." Or write directly to us for literature.

*Patent Nos. D178605; D178659

And the most weathertight cover ever offered as standard construction

New Butlerib panels are not only beautiful, they're extremely functional. The new corrugated pattern makes them the strongest, most rigid cover panels ever offered on Butler buildings. This means that there's even less deflection under wind and snow loads. Joints stay tight and snug.

Butlerib panels offer maximum protection at lowest cost. Secured with modern self-clinching fasteners (see photo at right), Butlerib panels are installed quickly . . . economically. And they do not require the costly maintenance and repairs of traditional construction.

BUTLER®

BUTLER MANUFACTURING COMPANY
7321 East 13th Street, Kansas City 26, Missouri

Manufacturers of Metal Buildings • Equipment for Farming, Dry Cleaning, Oil Production and Transportation, Outdoor Advertising • Contract Manufacturing

Sales offices in Los Angeles and Richmond, Calif. • Houston, Tex. • Birmingham, Ala. • Kansas City, Mo. • Minneapolis, Minn. • Chicago, Ill. • Detroit, Mich. • Cleveland, Ohio • Pittsburgh, Pa. • New York City and Syracuse, N.Y. • Boston, Mass. Washington, D. C. • Burlington, Ontario, Canada

A full 3 feet wide and available in lengths up to 32 feet, Butlerib panels make short work of covering even the largest Butler buildings. The unique pattern of deep and shallow corrugations makes these the most rigid panels of their type.

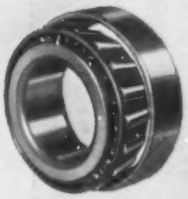
The Positive Seal
PERMA-SAFE
Wheel

Truck wheels, front idlers, support rollers on all models of Allis-Chalmers crawler tractors

Lubricated at factory need no further greasing

Every Allis-Chalmers crawler tractor—whether produced today or any time during the past 17 years—offers its owner the twin secrets of permanent lubrication.

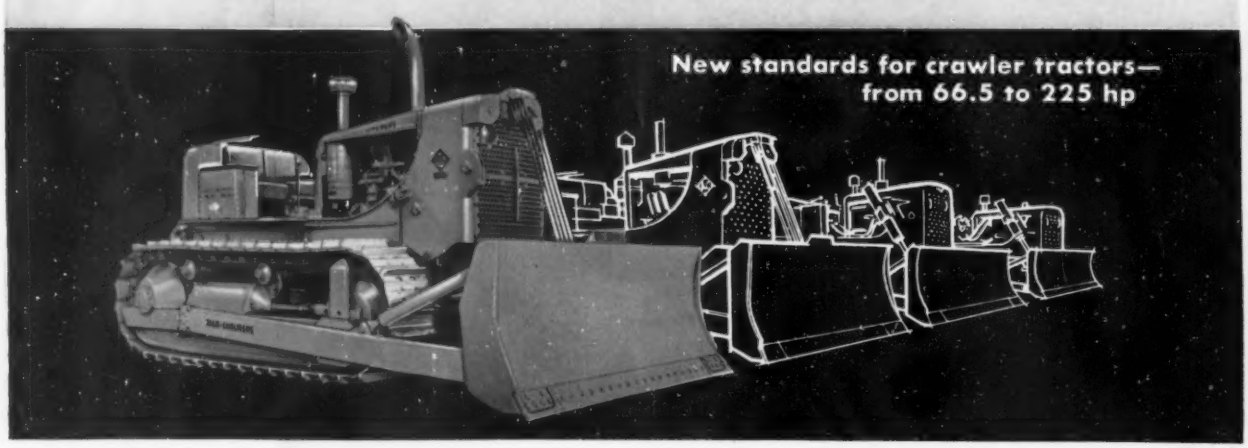
1



Allis-Chalmers tapered roller bearing wheels roll much more freely than ordinary bushing types . . . reduce power-robbing friction . . . give you more of your engine's horsepower at the drawbar or moldboard where it pays off in production. The tapered roller bearings maintain precise alignment of all parts . . . protect the perfect seal by minimizing side thrust and wobble . . . eliminate the uneven wear that makes positive sealing of bushing-type assemblies impractical.

2

The "Positive Seal" that makes permanent lubrication possible is effected by two steel sealing rings working in combination with the tapered roller bearings. These two rings, smoother than glass, are held firmly together by strong steel coil springs. One seal remains stationary; the other turns with the truck wheel. These seals are micro-finished to near perfect flatness. Their surfaces fit together so precisely that nothing can get through . . . a perfect seal.



Safe, permanent lubrication of truck wheels, front idlers and support rollers requires seals that will keep all moisture and other foreign materials out . . . the lubricant in. Only Allis-Chalmers offers seals which are positive because of their use in combination with tapered roller bearings. The Allis-Chalmers Positive Seal, tapered roller bearing design has been proved in the field through more than 20 years . . . through millions upon millions of operating hours. When introduced in 1938, this outstanding design replaced bushing-type assemblies similar to those used today in other tractors. Allis-Chalmers abandoned bushing-type truck wheels because, in its opinion, they could not be positively sealed.

Your Allis-Chalmers dealer will be happy to help you estimate the savings in time and material that are yours with Allis-Chalmers permanent lubrication. See him today. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

move ahead with ALLIS-CHALMERS

...power for a growing world

Austin-Western variable 3½ to 6-ton portable tandem roller demonstrates superior maneuverability.

"A-W portable tandem roller cuts costs, does better compaction job faster!"

says Elizabethville, Pa., street supervisor

"An excellent piece of compaction equipment," says Jack Wells, street supervisor for the Borough of Elizabethville, Pa. He's referring of course to Austin-Western's variable 3½ to 6-ton portable tandem roller.

Easy to operate

He adds, "It works fast and does a superior job of compacting. It's easy to operate, too. You can operate the hydraulic steering controls from either right or left side with equal ease on the comfortable full-width seat. Visibility is good. You can look right down and see what you're doing at all times. You can roll within a quarter-inch of curbing!

"And it's economical. We haven't had any downtime or maintenance problems. Removable panels make service and adjustments very easy. We have some steep grades in the borough, but the A-W travels to jobs under its own power. It always does a good compaction job, on any grade.

Pays for itself

"In one 3-month period, we used it to apply 9000 sq. yd. of the smoothest blacktopping you've ever seen. And at a good saving. The A-W roller is really helping to pay for itself!"

A-W variable weight rollers are designed for high quality, low cost compaction. Also available in 5-8, 8-12 and 10-14 tons tandem—8-11, 10-12 and 12-14 tons with three wheels.

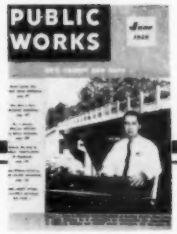
Learn for yourself about this popular line of rugged variable weight rollers. See your nearby Austin-Western distributor or write us today!

Austin 100th YEAR **Western**

CONSTRUCTION EQUIPMENT DIVISION, AURORA, ILL.

BALDWIN · LIMA · HAMILTON

Power graders • Motor sweepers • Road rollers • Hydraulic cranes



Marion Wilkins is county engineer of Conecuh County, Alabama, a position he has held since 1952. As county engineer he is responsible for personnel and purchasing, programming, budgeting, surveys and plans, construction and maintenance of roads and bridges. At present there are 250 miles of paved roads and approximately 650 miles of dirt roads of various classes in the county. Each year 30 miles of paved roads and bridges are constructed. The county is fully equipped to do all the construction and to maintain the roads now constructed.

Mr. Wilkins was educated in Alabama public schools and graduated with a civil engineering degree from Alabama Polytechnic Institute. He also attended graduate schools at Harvard and MIT for a short time. After serving 3 years in the Air Corps during World War II, he worked 2 years for a private engineering firm and then served as county engineer of Monroe County, Ala., for 3 years, before going to Conecuh County.

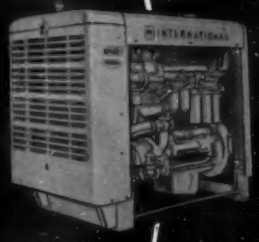
In addition to his county duties, he has constructed for the county recreation board a 65-acre recreational lake and a 5400-sq. ft. municipal swimming pool for the City of Evergreen. He is also Civil Defense Director of Conecuh County and engineering officer for the Evergreen CAP Squadron.

He is a member of the National and Alabama Association of County Engineers, Chi Epsilon, Tau Beta Pi, a registered professional engineer and land surveyor and a holder of a 1st Class Commercial Radio Telephone Operators License.

Mr. Wilkins is married and has two boys. Recently they just completed an 8500 mile tour through 21 states in the midwest and west.

V-8's

Presenting
24 engines
featuring

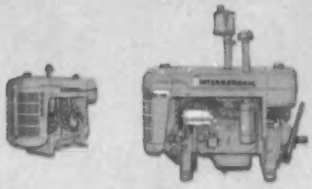


6's

Fastest
Payback
Power

4's

16.5 to 385 hp diesel and carbureted



UC-60
16.5 max. eng. hp

UC-135
42 max. eng. hp

UC-221
75 max. eng. hp

UB-220
83 max. eng. hp

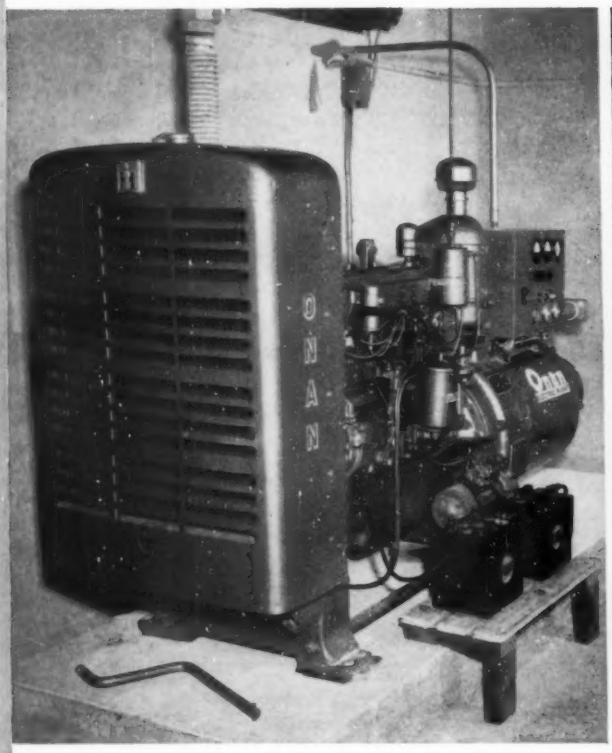
U-308
92 max. eng. hp

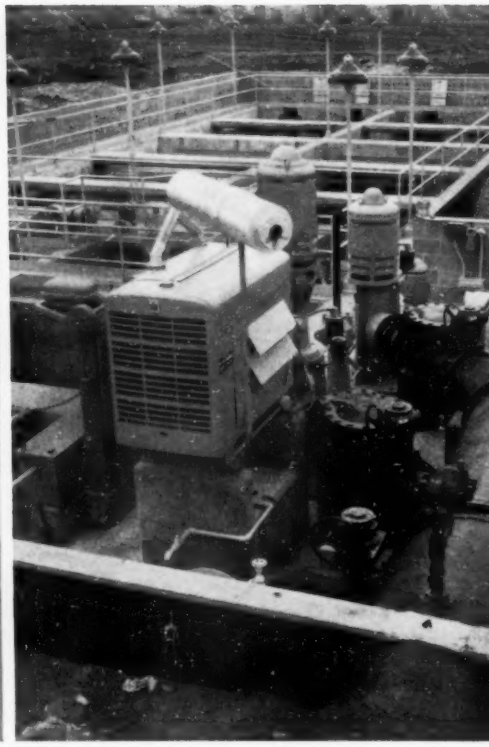
UC-2
95 ma

TEAR OUT AND FILE

WITH INTERNATIONAL

Fastest Payback Pow



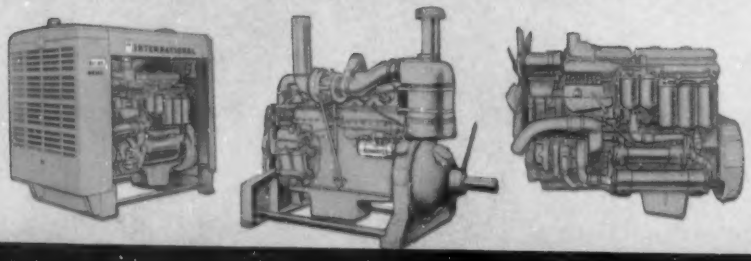


UDT-817
375 int. eng. hp

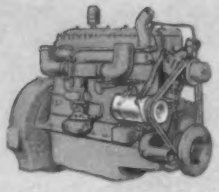
UDT-1091
265 int. eng. hp

UD-817
240 int. eng. hp

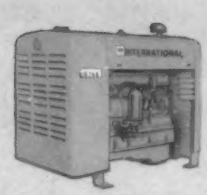
UD-1091
216 int. eng. hp



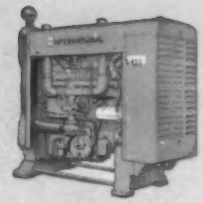
JC-263
5 max. eng. hp



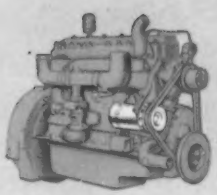
U-372
110 max. eng. hp



UB-264
112 max. eng. hp

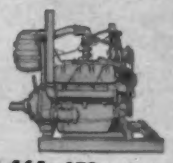


U-450
134.5 max. eng. hp



U-501
141 max. eng. hp

UV-401—**170 max. eng. hp**



UV-461—**179 max. eng. hp**

UV-549—**222 max. eng. hp**

U-1091—**248 max. eng. hp**
(nat. gas)

CARBURETED

DIESEL

UD-236—**70 int. eng. hp**

ower starts with your equipment engines

Your best equipment investments are dependable machines that pay for themselves fastest on the job. And by powering those machines with International you can make sure fastest payback power starts in your equipment engines.

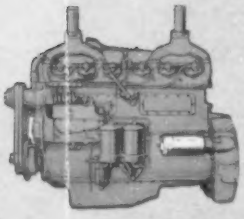
International engineers with over a half century of heavy-duty engine design experience make fastest payback power the common feature of all International engines through lowest cost operation, long-working stamina, thorough sealing, and minimum maintenance.

And it's easy to match International power exactly to your machines without overpowering or underpowering. Choose from 24 models from 16.5 to 385 max. hp. Choose the desired fuel from 10 diesels and 14 natural gas, LPG or gasoline carbureted models in 4's, 6's, and V-8's.

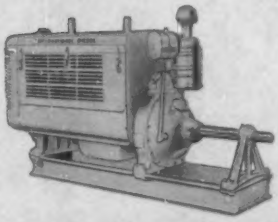
All 24 models are available from stripped engines to complete power units. A wide variety of accessory equipment including air cleaners, flywheels for leading makes of torque converters and clutches, torque converter coolers, air compressors, safety shut-offs, instruments and engine controls can be furnished for your installation requirements. Bases, radiators, hoods and dashes, clutches and power take-offs can be ordered for complete power units.

Get full details on any model from your International Power Unit Distributor or Dealer, the man who sells and services fastest payback power.

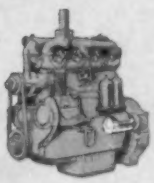
UD-554
140 int. eng. hp



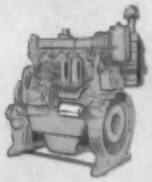
UD-18A
131.5 int. eng. hp



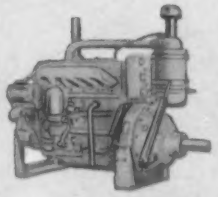
UD-14A
105 int. eng. hp



UD-370
95 int. eng. hp



UD-282
90 int. eng. hp



Your choice of engine sizes and fuels,
all with *Fastest Payback Power*

Your International Power Selector

	MODEL	RATED RPM	CU. IN. DISPLACEMENT	GASO. HP	LPG HP	NAT. GAS HP
FOURS	UC-60	2500	60	16.8		
	UC-135	2000	135	42	42	32
	UC-221	2400	221	75	75	66
	UB-220		220	83	83	70
SIXES	U-308	2400	308	92	96	82.5
	UC-263	2400	263	95	95	85
	U-372	2200	372	110	101	92.5
	UB-264		264	112	112	90
	U-450	2200	450	134.5	130.5	112
	U-501	2200	501	141	134	120
V-EIGHTS	UV-401	2800	401	170	165	142
	UV-461	2600	461	179	175	162
	UV-549	2600	549	222	215	192

	MODEL	RATED RPM	DISPLACEMENT	MAX. TORQUE AND RPM	BORE & STROKE IN.	INTERMITTENT HP
FOURS	UD-370	2200	370	262 @ 1400	4⅝ x 5½	95
	UD-14A	1800	460.7	325 @ 900	4¾ x 6½	105
	UD-236	2400	236	173 @ 1800	3 11/16 x 3 11/16	70
	UD-282	2400	282	217 @ 1800	3 11/16 x 4.39	90
	UD-554	2300	554	400 @ 1300	4⅝ x 5½	140
SIXES	UD-18A	1600	691.1	473 @ 850	4¾ x 6½	131.5
	UD-1091	1500	1090.6	825 @ 1150	5¾ x 7	216
	UDT-1091	1500	1090.6	1000 @ 1250	5¾ x 7	265
	UD-817	2100	817	638 @ 1600	5⅜ x 6	240
	UDT-817	2100	817	1052 @ 1200	5⅜ x 6	375

NOTE: *For carbureted engines use 90% of max. hp shown for intermittent type application and 80% of max. hp for continuous type application. For diesel engines use 80% of intermittent hp shown for continuous duty application.*

Specifications subject to change without notice.

International® *Construction Equipment*

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors . . . Self-Propelled Scrapers and Bottom-Dump Wagons . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Haulers . . . Diesel and Carbureted Engines . . . Motor Trucks . . . Farm Tractors and Equipment.

INTERNATIONAL HARVESTER COMPANY
180 NORTH MICHIGAN AVE. • CHICAGO 1, ILLINOIS

Clay Pipe for Long-Range Economy

MADISONVILLE, KENTUCKY, is so efficiently managed that for the third successive year no property taxes were levied. With this record for efficiency, it is only natural that corrosion-proof Clay Pipe was chosen for the city's new sewerage expansion program. More than twenty-two and a half miles of Vitrified Clay Pipe are going into the project.

In the opinion of J. Sanders Parker, Consulting Engineer, Clay Pipe is "the best that could be obtained for this service." Clay Pipe never wears out . . . does not rust, rot, or disintegrate . . . is the only pipe backed by a long-term written guarantee. And the new stronger, longer lengths speed installation . . . cut labor costs.

When investigating materials for sewer expansion, remember . . . Only Clay Pipe has *all* the features you can trust.

Public Officials: David Parish, Mayor; A. O. Johnston, *Councilman, Chairman of Water and Sewers.*

Consulting Engineers: J. Sanders Parker; F. E. Stepp, *Resident Engineer.*

Contractors: C. F. W. Construction Co., Inc.; Sterrett Construction Co.

C-458-1

Vitrified **CLAY PIPE** *Never Wears Out*

NATIONAL CLAY PIPE MANUFACTURERS, INC. 1820 N Street, N. W., Washington 6, D.C.
311 High Long Bldg., 5 E. Long St., Columbus 15, Ohio • 703 Ninth & Hill Bldg., Los Angeles 15, California • Box 172, Barrington, Illinois • 1401 Peachtree St., N. E., Atlanta 9, Georgia

AIRPLACO

ADVANCED DESIGN EQUIPMENT SAVES DOLLARS ON CONCRETE WORK

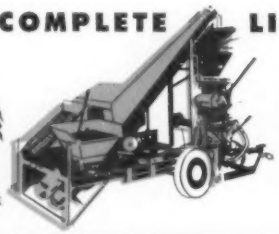
SAVE on bridge repair

SAVE on sidewalk and curb repair

SAVE ON ALL CONCRETE CONSTRUCTION AND RESTORATION WITH AIRPLACO

You save cold, hard cash when you use AIRPLACO "Advanced Design" concrete gunning and placing equipment. You save valuable time—speed up work. Save on labor—fewer men get more work done. Save on materials—get higher efficiency, more versatility. Investigate AIRPLACO for your next concrete job.

COMPLETE LINE



AIRPLACO offers you a complete line of concrete guns, portable mixers, grouters, placers, sandblasters and a complete line of accessories.

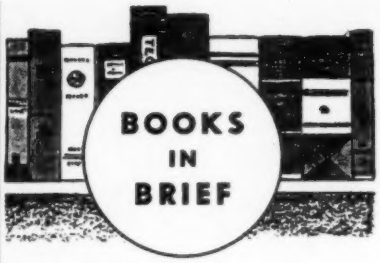
FREE CATALOG

AT YOUR SERVICE — Draw upon the experience of the world's leading manufacturer of pneumatic concrete placing equipment. Let us help you solve your concrete maintenance and restoration problems. Write, wire or phone, anytime.

AIRPLACO AIR PLACEMENT EQUIPMENT CO.

1013 WEST 24TH ST. • KANSAS CITY 8, MO.

WORLD'S LEADING MANUFACTURER OF "ADVANCED DESIGN" PNEUMATIC PLACING EQUIPMENT



RAPID TESTS FOR AGGREGATE AND CONCRETE

This 23-page bulletin contains two papers on this subject presented at the 37th Annual Meeting of the Highway Research Board. "Use of Swiss Hammer for Estimating Compressive Strength of Hardened Concrete," by William E. Grieb, describes a simple, quick, nondestructive test method for estimating compressive strength of hardened concrete in place. It can be used in the field as well as in the laboratory. "Rapid Freezing and Thawing Test for Aggregate," by R. H. Brink, describes a method using a water-alcohol solution as the freezing medium in place of the common sulfate soundness test. Copies of Bulletin 201 are available from Highway Research Board, 2101 Constitution Ave., Washington 25, D. C., and are 50¢ each.

FIELD INSPECTION OF BUILDING CONSTRUCTION

This is a comprehensive handbook on the supervision of building construction by the architect, engineer and the field inspector. It defines and explains responsibilities for such matters as quality of materials and workmanship, coordination of work by different trades, schedules, storage of materials, provision of utilities and services, safeguarding of work in place, safety precautions and other vital functions. The publisher of this 352-page book is F. W. Dodge Corp., 119 West 40th St., New York 18, N. Y., and copies are $9.35 each.

PHOTOGRAMMETRY—DEVELOPMENTS AND APPLICATIONS: 1958

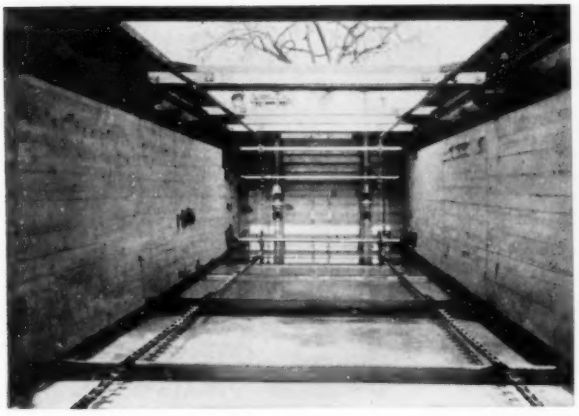
Bulletin 199 contains the Report of the HRB Committee on Photogrammetry and Aerial Surveys, together with seven papers and their discussions on these subjects as presented at the 37th Annual Meeting of the Highway Research Board. Included are the following papers: "Adjustment of State Plane Coordinates," by William T. Pryor; "Survey Security Through Photogrammetry," by D. E. Winsor;

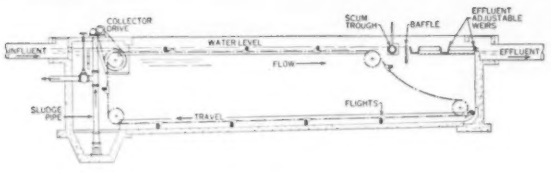
WHICH SLUDGE COLLECTOR

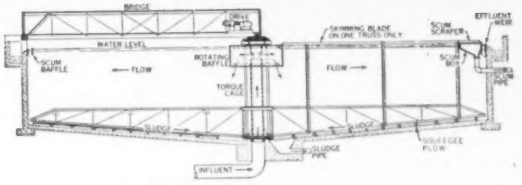
can do the best job for you?

For maximum efficiency . . .
minimum disturbance of flow . . .
choose LINK-BELT
STRAIGHTLINE sludge collectors

For large installations
where construction economies
are vital . . . it's LINK-BELT
CIRCULINE sludge collectors







STRAIGHTLINE COLLECTORS are scraper conveyors made in various styles to handle sludge and scum in *rectangular tanks*. Straightline design means the shortest possible travel for the collected material. It also permits a steady slow speed of the collecting flights that is uniform over the entire floor surface of the tank. This results in maximum efficiency with minimum disturbance to the flow. Straightline collectors can also be installed in the Link-Belt Uniflow settling tank—an improved rectangular design combining a rapidly sloping bottom with a system of multiple effluent weirs.

CIRCULINE COLLECTORS are installed in either rectangular or round tanks. Link-Belt offers four series—R, S, T and C. Series R are usually installed in circular tanks and are used to remove settled sludge from the tank floor and scum from surface of liquid. Series S are for square tanks, or rectangular tanks where sludge is collected only from the influent end of tank. Series T are similar to Series R, except they are built to withstand torques encountered in removing heavy settled solids. Series C have both the economical feature of circular tank construction and the positive sludge and scum collection of a straightline sludge collector.

Sludge collectors are only a part of the broad line of Link-Belt sanitary engineering equipment. Get in touch with the Link-Belt office nearest you. Our sanitary engineers will be glad to work with your engineers, chemists and consultants . . . help you get the finest in modern treatment methods. Or write for Water, Sewage and Industrial Waste Treatment Equipment Book 2617 and Uniflow Settling Tank Folder 2648.

LINK-BELT

SANITARY ENGINEERING EQUIPMENT

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. Sanitary Engineering Regional Offices—Colmar, Pa., Chicago 9, Kansas City 8, Mo., San Francisco 24. Sales Offices in All Principal Cities. Export Office, New York 7. Representatives Throughout the World.

Dodson's Digest

Dusted off

"A little dust never hurt anybody, Dod. Now that's my final word for today on the subject of Calcium Chloride."

This Fred Hinton was really a tough customer when it came to controlling dust on the county roads with Calcium Chloride.

Fred is a county road commissioner and I had been chauffeuring him in my car all over his county one day last month so that I could give him all the facts about Calcium Chloride – about how it eliminates chuckholes, prevents loss of material, offers a harder driving surface and . . .

But it was almost sundown, so I drove Fred back to his office, resolving to try again another day.

About two weeks later, I got a phone call from Fred.

"Dod, I need a shipment of Calcium Chloride and I need it fast! Enough to cover all our unimproved roads!"

I assured Fred that he would get supersonic service and thanked him for his order.

Although I was puzzled at his sudden about-face, I didn't say anything to Fred.

Happened to mention it to my secretary later on that day.

"Well, Mr. Dodson, I don't know if this has anything to do with it or not, but I heard that the Hintons have just bought a lovely home out in the country."

"But what . . ."

"And right alongside their home runs an unpaved road that's probably the dustiest in the county, and they say Mrs. Hinton put her foot down, and . . ."

– L. D. Dodson

P.S.—Get the full story on how Wyandotte Calcium Chloride can help *you* stop your dust problems. Write me today for our free folder, "How To Stop Bothersome Dust". *Wyandotte Chemicals Corp., Wyandotte, Michigan. Offices in principal cities.*

Wyandotte CHEMICALS

MICHIGAN ALKALI DIVISION

HEADQUARTERS FOR CALCIUM CHLORIDE

"Earthwork Data Procurement by Photogrammetric Methods," by C. L. Miller and T. Kaalstad; "10-Foot Portable Subtense Bar," by D. E. Winsor; "Aerial Mapping in Areas of Heavy Ground Cover," by Irvin Sternberg; "Photographic Targets for Markers of Survey Control," by William T. Pryor; and "Photogrammetric Map Accuracy," by L. L. Funk. Copies of the 82-page bulletin cost $2 each and are available from Highway Research Board, 2101 Constitution, Washington 25, D. C.

LINEAR STRUCTURAL ANALYSIS

This is an introduction to the influence coefficient method applied to statically indeterminate structures. It is designed both as a college textbook and as a foundation for practicing engineers who wish to follow the development of modern methods. The author is P. B. Morice, Professor of Civil Engineering, University of Southhampton, England. The book contains 170 pages and is available from The Ronald Press Co., 15 East 26th St., New York 10, N. Y. Copies are $6 each.

COMPILATION OF ASTM STANDARDS IN BUILDING CODES

This volume, containing over 200 standards in their latest form, is a completely new edition of the compilation of ASTM standards found in building codes first published in 1955. It includes 18 standards not previously included in the original 1955 edition or its 1956 supplement. Building codes throughout the United States and Canada have adopted, by reference, a large number of ASTM standards as authentic criteria of quality and established procedures for building materials and constructions. The 1080-page paper bound volume sells for $8 to non-members of ASTM and $6.40 to members. It is available from American Society for Testing Materials, 1916 Race St., Philadelphia 3, Penna.

STUDIES IN HIGHWAY ADMINISTRATION

Bulletin 200 contains seven papers on highway administration at the state, county and local levels as presented at the 37th Annual Meeting of the Highway Research Board. The following papers are included: "Principles of Delegation of Authority and Responsibility in a Highway Department," by K. L. Bergstrahl; "Decentralization in Highway Administration," by W. L. Haas; "Wisconsin's Education and Training for Highway Construction Engineering Aides or Technicians," by C. L. Greiber; "A Program for Development and Research in Local Rural Highway Administration," by Keith F. Jones; "Effect of the New Interstate System on Intergovernmental Relations in Kansas," by Clarence J. Hein; and "Considerations and Methods for Developing Metropolitan Area Transportation Studies," by T. J. Owens. Copies of this 50-page bulletin are $1 each and are available from Highway Research Board, 2101 Constitution, Washington 25, D. C.

STRUCTURAL BEHAVIOR OF A PLATE RESEMBLING A WINGWALL

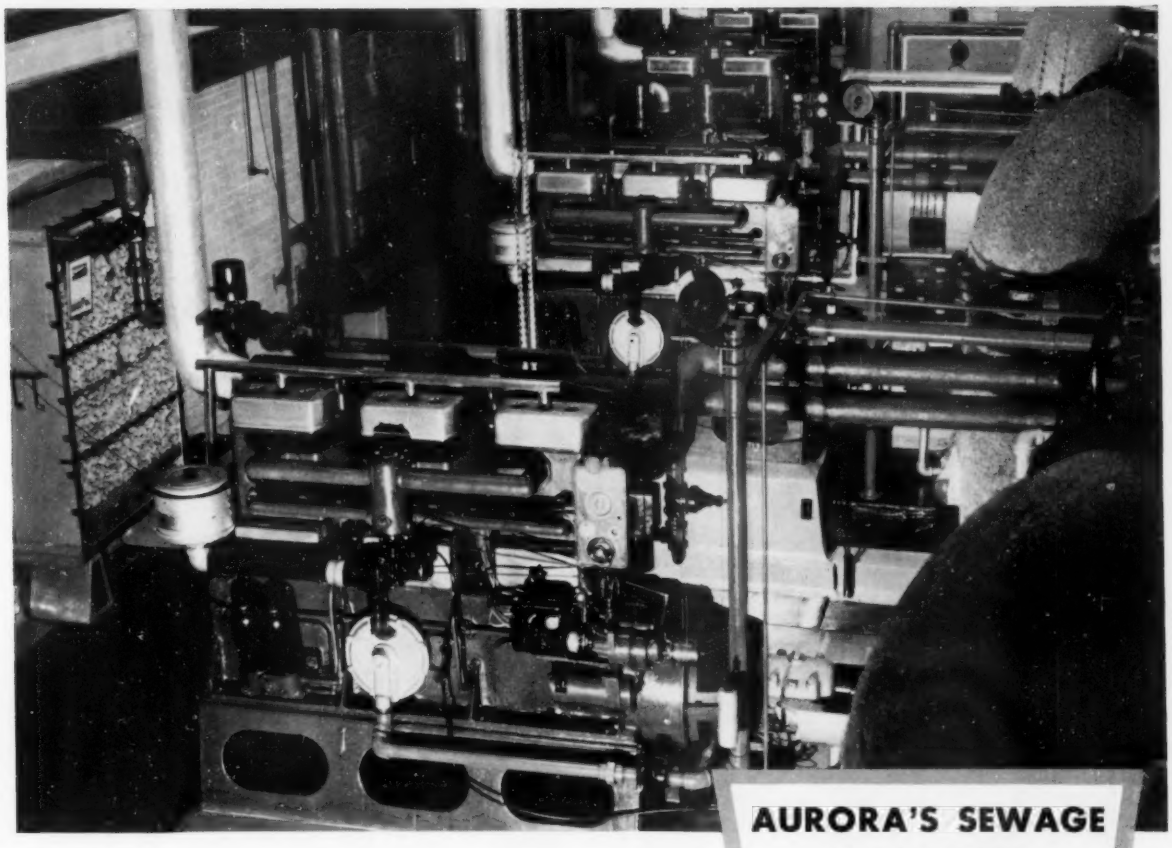
Bulletin #182 reports the first two phases of the project on bridge abutment wingwalls of the flared type. The project being done at the Iowa Engineering Experiment Station has been sponsored by the Iowa Highway Research Board of the Iowa State Highway Commission. Phase one includes a comprehensive literature review and a questionnaire survey. Phase two includes the results of a study to establish a feasible analytical method for the solution of this type of plate problem. Copies of this bulletin are available from The Iowa Engineering Experiment Station, Iowa State College, Ames, Iowa, at 75¢ each.

WELDED WIRE FABRIC REINFORCEMENT

Technical Bulletin No. 238 covers the report entitled "Welded Wire Fabric Reinforcement in Asphaltic Concrete Overlays," by Edward M. Howard, Field Engineer, Wire Reinforcement Institute. It is a summary of recommended practices relating to styles and sizes of welded wire fabric, asphaltic mixtures and aggregate sizes, minimum thicknesses and installation procedures. Copies of the bulletin are 50¢ each and are available from American Road Builders' Association, World Center Building, Washington 6, D. C.

SKID-PROOFING HIGHWAYS USING BLAST FURNACE SLAG

"Skid - Proofing City Streets, County and State Highways Using Blast Furnace Slag," is the title of Technical Bulletin No. 241 published by ARBA. Written by E. W. Bauman, Managing Director, National Slag Association, the bulletin covers nonskid or skid resistant surfaces and how they may be constructed. Copies are available from the American Road Builders' Association, World Center Bldg., Washington 6, D. C., and are $1 each.



for over 22 years

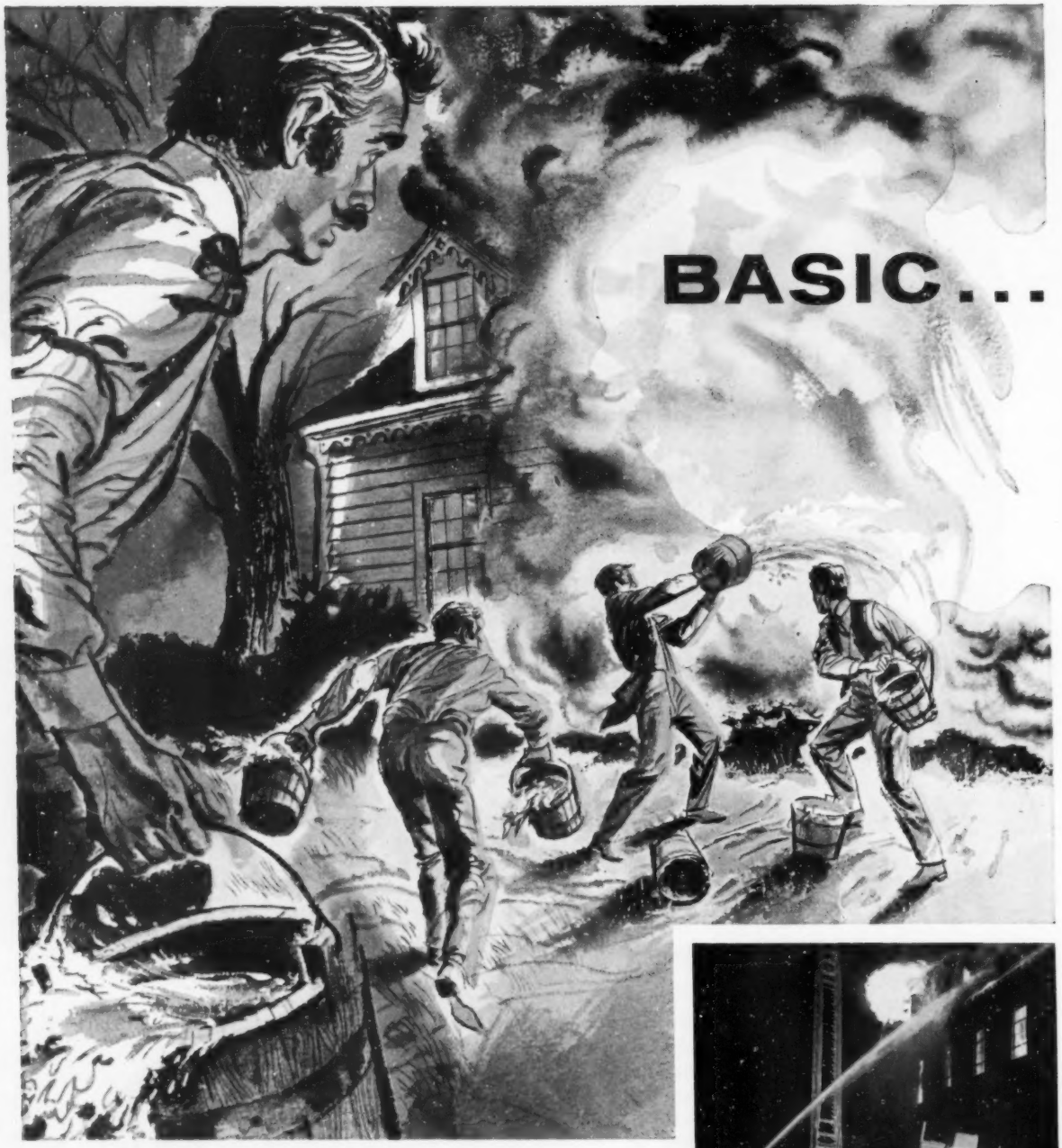
AURORA'S SEWAGE TREATMENT PLANT has been POWERED by these

CLIMAX ENGINES

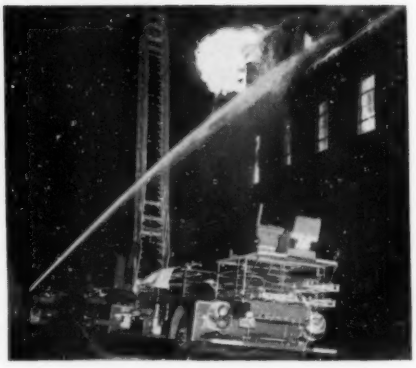
The Aurora Sanitary District, Aurora, Ill., installed two 75 hp, six-cylinder Climax pump engines in 1936. These direct-connected engines performed so well—always starting under load—that, in 1940 two 50 hp Climax engines in generator sets were added. All four engines had sewage gas and gasoline carburetors. In 1953, gasoline was replaced by natural gas as standby fuel. This gave the plant four-way safety—duplicate engines . . . two fuels . . . two ways to start generator engines . . . freedom from electric storm interruption. After 22 years, 8 months, pump engines had paid for themselves 4.78 times; generator engines 2.5 times after 17 years. Year after year Climax engines keep on making records like this. 40 to 610 hp; V-type—four models, 8 and 12 cylinder; in-line type—four models, 4 and 6 cylinder. Capable of operation on sewage gas, natural gas, butane, gasoline, or any combination. Send for complete power chart and bulletins.

CL-104

CLIMAX ENGINE MANUFACTURING CO.
DIVISION OF WAUKESHA MOTOR COMPANY
FACTORY AT CLINTON, IOWA



THE BUCKET BRIGADE of earlier days was willing but ineffective. Once started, a blaze usually raged to complete destruction.



MODERN FIRE FIGHTING APPARATUS, fed by a dependable water system of cast iron pipe, uses high pressure to place water where needed. Losses are minimized.

U.S. cast iron PIPE

FOR WATER, SEWERAGE AND

U. S. PIPE AND FOUNDRY COMPANY

but better than ever today!

Top quality of U. S. Pipe assured by rigid mine-to-main supervision

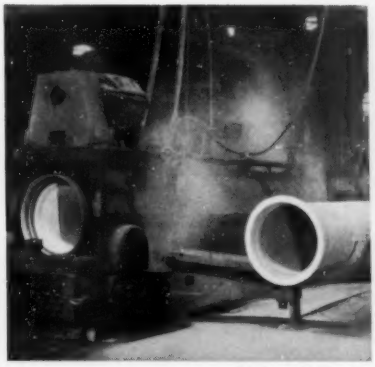
Cast iron pipe may look alike.

But there's a difference... an important difference to the men charged with keeping our water running smoothly— the nation's water officials.

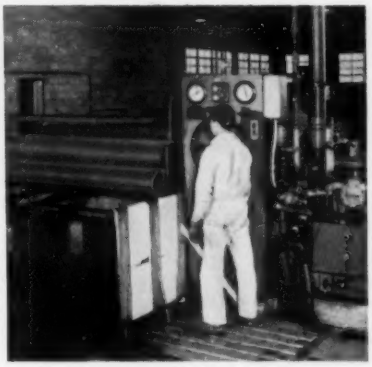
This is the care and precision with which pipe is made. U. S. Pipe, for example, controls every production step. From mining iron ore, through the blast furnace to final casting, all U. S. Pipe is continuously checked for quality.

Result? Even greater life and dependability for the U. S. Pipe that carries so much of America's water.

COAL is discharged mechanically into mine cars for transportation to the surface.



NEWLY CAST 24-inch pipe 18 feet long just removed from centrifugal casting machine.



EACH LENGTH of U. S. cast iron pipe is tested hydrostatically to a minimum of 500 psi on the production line.

INDUSTRIAL SERVICE CAST IRON

Birmingham 2, Ala. *A wholly integrated producer from mines and blast furnaces to finished pipe.*

The new lift span on the Celilo Bridge over the Columbia River is being raised to permit river passage. Westinghouse supplied all the major elements of the electrical system, which can raise the span to 75 feet above mean high water in 90 seconds.

Sid Brown, Westinghouse sales representative, at right, is shown discussing approval of electrical control system with Mr. Don Thomas, assistant engineer of structures for Spokane, Portland and Seattle Railway; Mr. Glen Emory and Mr. Ed Bohm, partners of Emory and Bohm, electrical contractors.

Celilo Railway Lift Bridge uses new Westinghouse static skew control

When construction of the Dalles Dam caused the Columbia River to rise closer to the deck of the Oregon Trunk Railway's Celilo Bridge, it became necessary to build a lift span to let river traffic pass beneath. A Westinghouse d-c adjustable-voltage drive, incorporating static skew control, was installed to provide smooth acceleration and a precise regulating system to keep the span level.

Set between two towers, the span is counterweighted and suspended by wire ropes passing over sheaves at the top of each tower. Two Westinghouse d-c mill motors in each tower drive the sheaves and are electrically synchronized by the d-c adjustable-voltage system to keep the span level when operating. The various operations are so interlocked that they must follow a predetermined sequence to assure maximum equipment and personnel safety. The skew control equipment has safeguards against abnormal conditions and requires minimum maintenance.

Westinghouse equipment used on the Celilo Bridge includes: the main d-c drive motors, brakes, motor-generator, control regulating exciters, control board, an operator's console, emergency drive a-c gearmotors and a 225-kva outdoor power center.

Westinghouse, as sole supplier of the coordinated electrical system, assumed undivided responsibility for its overall operation. For further information showing how this complete, single-source supply can benefit you, contact your Westinghouse electrical construction engineer, or write: Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pennsylvania. J-94116

Owner: Oregon Trunk Railway (Operated by Spokane, Portland & Seattle Ry.)
Consulting Engineers: Howard, Needles, Tammen & Bergendoff, Kansas City, Mo.
General Contractor: Kansas City Bridge Co., Kansas City, Mo.
Steel Fabricators: Pacific Car & Foundry Co., Seattle, Wash.
Electrical Contractor: Emory and Bohm, Portland, Oreg.
Westinghouse Distributor: Westinghouse Electric Supply Company, Portland, Oreg.

YOU CAN BE SURE...IF IT'S

Westinghouse

Over 250 Pages Westinghouse Data in Sweet's Construction File.

Chief operator, Champ King, at Westinghouse control desk. This desk centralizes the starting and stopping of railway traffic, selection of normal, auxiliary or emergency power supply, normal or emergency drive system and control of the lock and lift span.

Mr. Brown and Mr. Thomas inspect the interior of the main control cabinet which houses the Magamp* regulator panel and Rototrol® elements of the bridge control system.

*Trade-Mark

Mr. Bohm and Mr. Thomas examine the Westinghouse 33-hp Type MCA d-c mill motors, designed for heavy intermittent duty, which drive the main span machinery located at top of each tower.

Sanitary landfill helps Concord, N. H.,

Caterpillar No. 955 Traxcavator

Here you see the benefit of sanitary landfill to Concord, N. H. Sanitary landfill eliminates odors, insects and vermin. It eliminates the cost of sorting refuse. It costs less than incineration and, best of all, the Caterpillar equipment used for this operation can be used for other city work. Many cities are turning to sanitary landfill to get a cleaner city and to turn waste land into useful, salable property.

get a new park...a cleaner city

handles 3,600 yards of refuse per month

The old city dump in Concord, New Hampshire, is a thing of the past. In its place is an attractive new city park (shown below) and a sanitary landfill (left) that will eventually become a valuable industrial site. Every one of the 28,000 citizens of Concord will benefit from this modern way to handle refuse.

Key to the success of the landfill operation—which covers an area of approximately four acres adjacent to an industrial area—is the Caterpillar No. 955 Traxcavator which does the work. It is a 1½ cu. yd. 70 HP machine that is designed for quick, easy operation and fast cycle time. It handles 3,600 cubic yards of refuse a month. Total cost to the city of Concord for the sanitary landfill is only $0.94 per person, per year. Costs of the entire refuse disposal operation—pickup trucks, administration, wages, etc.—come to only $3.65 per capita, annually.

There are three Traxcavators in the Caterpillar line—the No. 933 (52 HP, 1⅛ cu. yd. bucket capacity), the No. 977 (100 HP, 2¼ cu. yd.) and the No. 955 which is being used so successfully at Concord. All three can be equipped with the exclusive Caterpillar side dump bucket. And all three can handle many more jobs—excavation, fill, snow removal, loading, street and alley work.

Your nearby Caterpillar Dealer can give you complete facts on the economics of sanitary landfill with Caterpillar machines. He's always handy when you need parts or service and he can help you select the right machine. Get in touch with him.

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

At Concord, N. H., refuse is dumped, compacted and covered lightly. When a layer six feet thick has been put down, a two-foot layer of soil is spread over it. Concord picks up refuse in residential areas once every two weeks... in business areas off Main Street, once every week... on Main Street, once a day.

CATERPILLAR

Caterpillar, Cat and Traxcavator are Registered Trademarks of Caterpillar Tractor Co.

YOUR TAXPAYERS GET THEIR MONEY'S WORTH WITH CAT-BUILT MACHINES

Want cobwebs on your complaint phone?

Then use Calgon* — for Calgon stops red water and lime scale — the two main causes of customer complaints. Yes, you can turn complaints into compliments, because whether the "red water" comes from iron present at the source, or iron dissolved from the pipes by corrosion, Calgon treatment is the answer.

When well waters containing iron and manganese are treated with a few parts per million of Calgon, the iron and manganese are kept in solution and the water is as clear at the consumer's tap as it was when pumped from the well.

When red water is caused by iron dissolved from the pipes, it can be prevented with Calgon† treatment because Calgon forms a protective film on metal surfaces. Moreover, this protective film also reduces costly tuberculation damage, flows are kept high and pumping costs are reduced. Calgon treatment is particularly effective after water main cleaning since the protective film forms quickly and tuberculation never gets a chance to start.

A report of a twenty-four month study on the efficiency of Calgon in maintaining pipeline flows is available. Ask for a reprint of this paper.

Write or phone for more information. An experienced Calgon engineer will be glad to make detailed recommendations on your specific problem.

* Calgon is the Registered Trade Mark of the Calgon Company for its glassy phosphate (sodium hexametaphosphate) products.

† Fully licensed for use under U.S. Patents 2,337,856, 2,304,850 and 2,358,222.

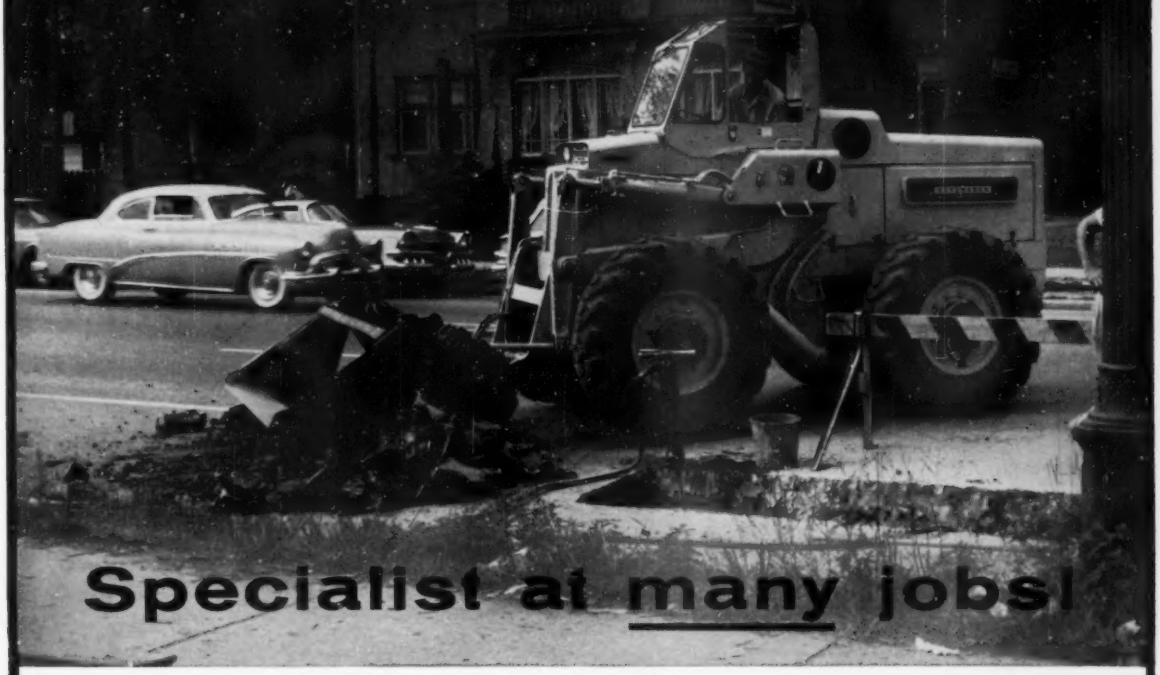
CALGON COMPANY

DIVISION OF **HAGAN** CHEMICALS & CONTROLS, INC.

HAGAN BUILDING, PITTSBURGH 30, PA.

In Canada: Hagan Corporation (Canada) Limited, Toronto

PAYLOADER®



Specialist at many jobs!

PAYLOADER®
ATTACHMENTS
help hold down the equipment budget

Drott 4-in-1 Bucket • Wain-Roy Back Hoe
Ram Leaf Loader • Vibratory Compactor
Ram Black-top Spreader • Winch
Ram Pick-up Street Sweeper
Superior Side Boom • Hydraulic Grapples
Ram Rotary Snow Plow
"V", Reversible & One-Way Plows
Angling Backfiller Blade
Crane Hook • Fork Lift • Scarifier Teeth

More than 10,000 "PAYLOADER" units have gone into public service — more than all other makes of rubber-tired tractor-shovels combined. They have played an important part in helping county, township, city and state governments get more mileage from each tax dollar.

A "PAYLOADER" is a better buy today than ever before — not only because of the Hough policy of continuous product improvement — but also due to the widest choice of attachments available. Some of these attachments are new, and obtainable only on "PAYLOADER" tractor-shovels. They make it unnecessary to purchase expensive specialized machinery in many instances.

Whatever way you measure tractor-shovel value, you'll find that "PAYLOADER" — the specialist at *many* jobs — is still the No. 1 buy for public bodies.

send for this
FREE BULLETIN

"No. 1 in Public Service" shows how all "PAYLOADER" sizes and their attachments save tax dollars.

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LIBERTYVILLE, ILLINOIS
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THE FRANK G. HOUGH CO.
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Send "PAYLOADER" catalog "No. 1 in Public Service"

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City _____ State _____

6-B-3

Equipment and Materials for your PUBLIC WORKS PROGRAM

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the reply card, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field of cities, counties or states.

NEW LISTINGS

New Manual Available on Base Stabilization

29. "Calcium Chloride for Stabilization of Bases and Wearing Courses" is the title of 34-page well-illustrated manual that deals with properties and design, types and methods of construction and specifications. Check the reply card or write Calcium Chloride Institute, 909 Ring Bldg., Washington 6, D. C.

Nine Ways to Better Concrete

86. Simplifying the complexity of concrete production, Bulletin P-36B contains a concise analysis of the nine vital factors governing the production of concrete. Charts, graphs and photos based on field and laboratory tests show how the use of Pozzolith will give better concrete. Check the reply card or write The Master Builders Co., Cleveland 3, Ohio, for this valuable data on concrete for highway and building construction.

Electric Plant Selection Guide

36. An aid in the selection of an electric light and power plant is available from Universal Motor Co., Oshkosh, Wis. Check the reply card for complete listings, specifications and helpful data on air-cooled electric light and power plants.

Entirely New Small Sewage Treatment Plant

40. The Sparjair units are package type plants that range in size from a 50 population equivalent to 5000 and utilize the contact stabilization process to produce a clear, nuisance free effluent. Copies of Bulletin 22-S-94 are available from Walker Process, P. O. Box 266, Aurora, Ill., or check the reply card.

Ten New Testing Apparatus for Highway Materials and Construction

43. Included in the new items are apparatus for concrete, soils and asphalt testing, and the Beggs Deformeter for solving problems involved in the design of indeterminate structures. Check the reply card or write to Soiltest, Inc., 4711 W. North Ave., Chicago 39, Ill.

Prestressed Concrete Tees for Bridge Construction

62. Leap tees capacity make them usable in the 60-125-ft. span range for roof decking and in bridge construction. Check the reply card or write Leap Associates, P. O. Box 1053, Lakeland, Fla., for full details.

Neptune Water Conditioning For Swimming Pools

75. Design, operation, features, comparative features, filter data and specifications of the Neptune system for swimming pools are covered in Bulletin No. 56S from Neptune Filters, Inc., 1090 New London Ave., Cranston, R. I. Check the reply card.

Pneumatically Applied Concrete for General Construction

119. A catalog describing and illustrating the complete line of Blastcrete guns is available from Blastcrete Co., Inc., 323 East 58th St., Los Angeles 11, Calif. Check the reply card.

Bituminized Fibre Duct for Highway Lighting

120. Direct burial (without concrete encasement) fibre duct, for lighting and other installations, is easy to lay, watertight and is highly resistant to heat and corrosion. Check the reply card or write Brown Co., 150 Causeway St., Boston 14, Mass., for full data.

6 Tools in 1 for Soil Preparation

125. The Sherman-Gill soil working tool is designed for the Ford tractor and can scarify, grade, level, break clods, pulverize, roll and firm and seed (with attachment). Check the reply card or write Sherman Products, Inc., Royal Oak, Mich.

Catalog on Industrial and Motor Controls

143. Catalog illustrates and describes B/W magnetic contactors, starters and reversing contactors, together with diagrams of enclosures and dimensions. Copies are available from B/W Controller Corp., 2211 East Maple Road, Birmingham, Mich., or check the reply card.

Steel Strain Poles are Octagonal in Shape

164. Data on the physical properties of strain poles, engineering drawings and complete specifications for traffic engineers are covered in Catalog No. S-1-4-59 from Kerrigan Iron Works, Inc., Nashville, 2, Tenn. Check the reply card.

Catalog on Rolling Doors and Partitions

220. Steel rolling service doors are described in catalog from The Cookson Co., 1525 Cortland Ave., San Francisco 10, Calif. Check the reply card for data on typical installations, detail sketches and complete architectural specifications.

Solve the Downtown Traffic Problem With Electronics

252. Signals are controlled by the traffic in the Electro-Matic PR system by using radar, the analog computer, electronic timing and electronic controls. Write Automatic Signal Div., Eastern Industries, Inc., Norwalk, Conn., or check the reply card.

Gravity Sewer Pipe Engineering Classifications

305. A quick method for choosing the most economical class of asbestos-cement sewer pipe to suit each laying condition with handy crushing table based on the Marston formula is available from Keasbey & Mattison Co., Ambler, Penna. Check the reply card.

Manual on Galvanized Steel Sheet for Garages and Storage Buildings

318. This is a compilation of up-to-date data available on the procurement of galvanized steel sheet and its applications, specification and purchase. Check the reply card or write the American Zinc Institute, Inc., 60 East 42nd St., New York 17, N. Y., for your copy.

Pneumatic Transmitter for Water and Sewage Operations

326. The Model AT-SD BalanCel pneumatic transmitter is specifically designed for transmitting rate of flow, loss of head and liquid level measurements over distances to operate meters, valves and controls. Check the reply card or write B-I-F Industries, Inc., 345 Harris Ave., Providence 1, R. I., for details.

Effluent and Waste Treatment Tanks Made of Glazed Tile

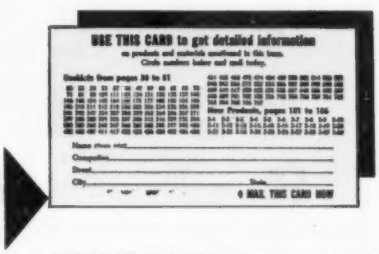
333. Stebbins Semtile and Semblock tanks are reinforced concrete structures faced on both sides with vitrified tile. Full details by checking the reply card or writing Stebbins Engineering and Mfg. Co., Watertown, N. Y.

Allis-Chalmers Engines and Power Units

334. Catalogs BU-52 & (G-149) and BU-531 (G-226) tell the design, engineering and performance capabilities of the units with the help of numerous illustrations. Check the reply card or write Allis-Chalmers Mfg. Co., Tractor Group, Milwaukee, Wis.

Electric Plants, Warning Flasher Lights and Concrete Vibrators

348. Models, specifications, accessories and other data on flasher lights, electric plants and vibrators are covered in catalog from Pacific Mercury, P. O. Box 190, Van Nuys, Calif. Check the reply card.



THE POINT OF NO RETURN...

HOW MANY WILL PASS IT ON YOUR HIGHWAYS TONIGHT?

A barely defined center line . . . the absence of a no passing stripe . . . and a motorist commits a fatal error of judgment. Unaware of the sharply dipping roadway and the oncoming car it conceals, he makes his move. In the next instant, the approaching auto is revealed . . . too late . . . he has passed the point of no return.

Properly laid pavement markings reflectorized with Cataphote Waterproof Reflective Traffic Beads can materially reduce nighttime traffic fatalities . . . in fair weather and foul. Many traffic engineers consider Cataphote Waterproof Beads one of their staunchest allies in a never-ending struggle to make streets and highways safer. And . . . a nationwide network of Cataphote Supply Centers assures them of prompt delivery . . . anytime . . . anywhere.

As long as there are roads to drive upon, drivers will err in judgment. Realizing this, the wise traffic engineer uses every means at his command to make existing highways safer. The man who fails to do so, commits the gravest error of all.

Cataphote
CORPORATION

TOLEDO 10, OHIO / JACKSON, MISSISSIPPI

Manufacturers of CATAPHOTE REFLECTIVE BEADS • CATAFLEX REFLECTIVE COATING • CATALINE REFLECTIVE STRIPING
CATATHERM REFLECTIVE PLASTIC STRIPING • TRAFFIC SIGNS • STREET NAME SIGNS

To order these helpful booklets check the reply card opposite page 38.

NEW LISTINGS (Cont.)

Trenchers for Water and Sewer Line Construction

384. Three Cleveland J trenchers incorporating major advances in trencher design and operating advantages are described in Bulletin L-104 available from The Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland 17, Ohio. Check the reply card for digging capacities, specifications and dimensions.

What a Camera in the Sky Means to You

413. This catalog is intended as a readily understandable description of the highly complicated science of Chicago Aerial Survey photogrammetry and how it can be of service to you. Check the reply card or write Chicago Aerial Survey, 10265 Franklin Ave., Franklin Park, Ill., for your copy.

Use The Reply Card

New Opportunity in Soil and Water Conservation

419. Catalog TL-2044 explains land treatment practices to save soil and water and is available from Tractor Group, Allis-Chalmers Mfg. Co., Box 512, Milwaukee 1, Wis. Check the reply card.

Exchange Down Time for Go Time

420. The parts exchange program of Caterpillar dealers is explained in an 8-page bulletin from Advertising Div., Caterpillar Tractor Co., Peoria, Ill. Check the reply card.

Key to the Perfect Swimming Pool

421. Equipment, supplies and chemicals for swimming pool operation are covered in Catalog No. 495 from Paragon Swimming Pool Co., Inc., P. O. Box 256, Pleasantville, N. Y. Check the reply card for this 32-page catalog.

New 3/4-yd. Capacity Shovel-Crane

426. Featuring speed-o-matic controls, this combination crane, dragline, shovel and hoe unit is described in Catalog No. 2725 available from Link-Belt Speeder Corp., Cedar Rapids, Iowa. Check the reply card.

Pavement Sealer Protects and Preserves Asphalt Pavement

450. Parking lots, airfield runways, driveways and playground areas are places where Koppers pavement sealer can be used. Check the reply card or write Koppers Co., Inc., Tar Products Div., Pittsburgh 19, Pa., for data on this easy to apply sealer.

Guide to Effective Sewage Disposal

458. A 40-page primer on sewage pumping and treatment is available from Yeomans Brothers Co., Dept. P, 1999 North Ruby St., Melrose Park, Ill. A variety of situations in the collection, disposition and treatment of sewage is covered. Check the reply card.

One Man Operated—Fully Hydraulic Truck Crane

459. Boom length which is hydraulically controlled extends to 13 ft. and can lift up to 6,000 lbs. Check the reply card or write Stanco Mfgs. & Sales Inc., 1666 Ninth St., Santa Monica, Calif., for complete data.

Aerial Platform for Tree and Street Lighting Maintenance

470. All models of the Strato-Tower are engineered to pass the most rigid standards and there are mountings for all vehicles. Check the reply card or write Strata-Tower Div., Young Spring & Wire Corp., P. O. Box 103, Elkhart, Ind., for specifications.

Diesel-Electric Power Plant on Wheels

476. Uninterrupted power under emergency conditions can be assured by trailer units assembled with diesel engine and electric generator. For full details write A. G. Schoonmaker Co., Inc., Foot of Spring St., Sausalito, Calif., or check the reply card.

Submersible Pumps for Municipal Water Supply

478. Submersible pumps from 3 through 125 hp in speeds of 3550 and 1750 rpm are described and illustrated in Bulletin B1200 available from Sumo Pumps, Inc., 23 Brown House Road, Stamford, Conn. Check the reply card.

Manual on Structural Shapes

479. This 80-page catalog has a wealth of information, engineering data, and tables for engineers, architects and designers of steel buildings and other steel structures. Check the reply card or write Bethlehem Steel Co., Bethlehem, Pa., for your copy.

Literature on Concrete Gunning Equipment

482. The placing of gunned concrete and the equipment used in this operation are described in literature from Air Placement Equipment Co., 1009 West 24th St., Kansas City 8, Mo. Check the reply card.

Drott TD-15 "4-in-1" Skid-Shovel

504. Features of the Drott skid-shovel are graphically depicted in 16-page, two-color catalog available from International Harvester Co., Consumer Relations Dept., 180 N. Michigan Ave., Chicago 1, Ill. Check the reply card for complete descriptions.

Complete Structural Systems and Curtain Wall Panels

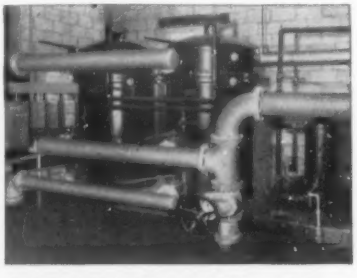
509. Available Stran-Steel shapes, applications, installation details, dimensions, and properties, for Stran-Steel joists and design examples are covered in catalog from Stran-Steel Corp., Detroit 29, Mich.

Steam Cleaners For City, County and State Highway Departments

510. Information is available on the Hypressure Jenny Steam cleaner from Homestead Valve Mfg. Co., Coraopolis, Pa. This unit can be used to clean street and highway signs, trucks, garbage equipment, bar screens and thaw frozen hydrants.

- BAKER PARK MUNICIPAL POOL, Frederick, Maryland, 400,000 gallons
- Filter System Design, W. R. Walter, City Engineer, Frederick, Maryland
- Filters: 2-SPF-169 R. P. Adams Company, Inc.

Shown is a typical Adams SPF Swimming Pool Filter installation. These filters are available in a wide range of sizes for pools of 50,000 to several million gallons capacity. All sizes are normally available from stock. We do not offer a filter for backyard pools.



HERE'S WHY MANY CITIES INSIST ON ADAMS Swimming Pool Filters

- **LOWER INSTALLATION COSTS** because it takes only a fraction of the floor space of sand filters . . . does not require massive concrete foundations.
- **TROUBLE-FREE OPERATION** . . . you never have to disassemble it for cleaning . . . as one city engineer said, "Yours is the only diatomite filter with backwashing that works".
- **PERMANENT PORO-STONE MEDIA** is inert to chemical corrosion and electrolytic action of chlorinated water. —All Adams SPF filters now in service are still equipped with the original tubes.
- **QUALITY IN EVERY PART** . . . stainless steel support rods and nuts for the tubes . . . galvanized forged steel closure plates and clips . . . *three* coats of vinyl plastic lining on sand blasted inner surfaces.

The R. P. Adams Company is the nation's largest manufacturer of filters exclusively for municipal, commercial and institutional pools.

For detailed information, write for our new technical Bulletin 626. It was prepared to help you with your swimming pool filter problems.

Our diatomite filters for municipal water supplies is discussed in Bulletin 651. Ask for it at the same time.

R. P. ADAMS CO., Inc. • 228 East Park Drive, Buffalo 17, N. Y.

8 out of 10 Sanitary Engineers assure

water-tight pipe joints

by using

TYLOX *flexible* GASKETS

There are more TYLOX Rubber and Neoprene Gaskets in low head service than all other types of gaskets combined! . . . Most waste disposal designers specify TYLOX Gaskets, knowing from experience that they prevent water from leaking *in* or *out* of pipe joints. The diagram below of a TYLOX Type "A" Gasket on straight T & G pipe shows how . . .

Whether you are planning pipe lines of B & S, T & G, offset or recessed pipe of *any* size, there's a Tylox Rubber or Neoprene Gasket in the Hamilton Kent family of true compression Gaskets to make the joints water-tight for the life of the pipe itself. If you are not already thoroughly familiar with the advantages of TYLOX Gaskets, write for full information and engineering details.

TYLOX prevents joint leakage with a compression-tight seal. It reduces pipe-laying costs with quick assembly and fast pipe coupling. Acid-resistant, TYLOX never deteriorates.

This TYLOX GASKETED PIPE is being used on the following sewer installation:

PROJECT: West Side Trunk Sewer, West Side Sanitary District, County of Onondaga, New York, Onondaga Public Works Commission.

ENGINEERS: O'Brien & Gere, Consulting Engineers, Syracuse, N. Y.

CONTRACTOR: M. A. Bongiovanni, Inc., Syracuse, N. Y.

PIPE: Reinforced Concrete T & G Pipe, Manufactured by American-Marietta Company, Concrete Products Division, Syracuse District, Syracuse, N. Y.

HAMILTON KENT
MANUFACTURING COMPANY
KENT, OHIO
427 West Grant St. ORchard 3-9555

5133

CANADIAN PLANT: 10 Brussels St., New Toronto, Ont., Phone CLifford 1-2494

To order these helpful booklets check the reply card opposite page 38.

WATER WORKS

In-Place Cement Lining of Small and Large Pipe

25. A catalog describing a process of in-place centrifugal cement lining of pipes from 4 to 144 ins. in diameter is available from the Centriline Corp., Raymond International Inc., 140 Cedar St., New York 6, N. Y. Check the reply card for sample specifications and test results.

Elevated Tanks and Other Storage Facilities

32. Specification sheet covering elevated tank sizes and design and illustrated brochure available from the Darby Corp., Kansas City 15, Kansas.

Propeller Meters For Dependable Water Metering Control

53. The complete line of Measure-Rite propeller meters are described in Bulletin MR-105 available from Measure-Rite, Inc., 4545 W. Brown Deer Rd., Milwaukee 18, Wis. Check the reply card for full details on these accurate meters.

Efficient Coagulation With Ferri-Floc

69. Advantages claimed for Ferri-Floc as a coagulant include wide pH range, quick floc formation, manganese removal control of certain tastes and odors plus other aids in high quality water production. Check reply card for complete Ferri-Floc data. Tennessee Corp., Grant Bldg., Atlanta, Ga.

Easily Cleaned Long Run Filter Bed Media

70. Bulletins on Anthrafilt tell the reasons why selected, graded crushed anthracite is superior to sand as a filtering material. Have you made a full investigation? Write Anthracite Equipment Corp., Wilkes-Barre, Pa.

Ball and Socket River Crossing Cast Iron Pipe

33. Literature is available describing Clow ball and socket cast iron pipe for river crossing, or any installation where full 15 degree free turning deflection is desirable. For full description and specifications, address James B. Clow & Sons, Inc., P. O. Box 6600-A, Chicago 80, Ill., or check the reply card.

Handbook of Cast Iron Pipes and Fittings

52. Full engineering data on products of the Alabama Pipe Co., including Super De-Lavaud cast iron pressure pipe and pipe fittings, valve boxes and other municipal castings are provided in Pressure Pipe Catalog No. 54, a 196-page publication of Alabama Pipe Co., Anniston, Ala. Weights, dimensions and specifications are clearly indicated in this easy to use in reference.

How Eleven Cities Installed Water Meters

56. This 8-page bulletin describes the planning and operational procedures used by 11 water departments and companies in the installation of about 200,000 water meters. Check the reply card or write The Ford Meter Box Company, Inc., Wabash, Ind., for methods of installation and rate cards.

Hydromat Asphalt Liners Manual

105. Hydromat applications, design factors, guide specifications for materials, reservoir lining and general engineering data are covered in 34-page catalog from W. R. Meadows, Inc., 25 Kimball St., Elgin, Ill. Check the reply card for this valuable catalog.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa., or check the reply card.

Convenient Reference Manual Covers Cast Iron Pipe, Valves and Hydrants

76. An 80-page manual, issued by R. D. Wood Co. Independence Sq., Philadelphia 5, Pa., presents specifications for "Sand-Spun" cast iron pipe and fittings, outlines types of joints available, lists dimensions and weights in convenient tables and includes, in addition, full engineering data on the Mathews and R. D. Wood fire hydrant and R. D. Wood gate valves.

Manual on Instrument Accessories and Supplies

96. The 60-page loose-leaf book, Catalog 500, includes specifications, part numbers and prices for more than 250 commonly furnished instrument parts and supplies. It is divided into 5 sections: Mechanical; pneumatic; electric-electronic, general, and tools and service. Check the reply card or write The Foxboro Co., Foxboro, Mass., for your copy.

AWWA Fire Hydrants and Gate Valves

155. Above-ground maintenance Mueller AWWA improved fire hydrants and minimum maintenance Mueller AWWA non-rising stem gate valves are described in literature from Mueller Co., Decatur, Ill.

Valve and Hydrant Construction Details

161. A 72-page catalog-type bulletin, just completed, gives detailed data on construction and application of gate valves, check valves and hydrants for water works service. Write for Bulletin 5710 from Darling Valve and Mfg. Co., Williamsport, Pa., or check the reply card.

Design of Prestressed Concrete Tanks

194. An 8-page technical Bulletin, T-19, on the Design of Prestressed Concrete Tanks, gives engineering data and formulas of general interest to anyone considering prestessed concrete for storage tanks. Check the reply card or write The Preload Co., Inc., 21 East 37th St., New York 16, N. Y.

NETCO CATCH BASIN CLEANER

Is Serving Many States, Cities and Turnpikes Throughout This Broad Land

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- East Cleveland, Ohio
- Cumberland, Maryland
- Indianapolis, Ind.
- Lansing, Michigan
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Easily mounted on any short wheel base truck with 8 ft. in back of the cab, the NETCO with orange peel or clamshell bucket can be operated continuously, averaging 20 to 30 catch basins a day. Hoisting capacity up to 1500 lbs.

NETCO does almost three times as many basins a day at less than half the cost per basin compared with old-fashioned manual methods.

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Years of efficient and economical use in every type of filter plant has made ANTHRAFILT the standard of excellence in the filtering medium field.

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Hoisington, Kansas, Water Works

TRIMS OPERATING COSTS WITH AUTOMATION

with Foxboro
TELETAX Telemetering
as first step

Foxboro Panel for TELETAX Control of isolated booster pumps is located at main treatment plant of Hoisington, Kansas Water Works. TELETAX Receiver (left) indicates and records storage tank level. Pressure Recorder (right) indicates and records clear-water level. Push buttons and acknowledgement lights are below instruments. *Consulting Engineers: Wilson & Co., Salina, Kansas.*

When you're operating booster pump installations out in the middle of nowhere, transportation costs for personnel can run mighty high. Hoisington, Kansas had that problem until they installed Foxboro TELETAX Telemetering. Now with TELETAX making the 14-mile round trip *electrically*, operators can stay at the main plant and turn the pumps on and off by push button. With TELETAX automatically tied in with other plant control functions, the resulting integrated system is expected to save almost $4000 yearly in operating expenses!

Here's what this modern control system will do — automatically: clearly indicate, record, and regulate level of clearwells and storage tanks; prevent pump operation whenever clearwells are dry or full; alert the operators immediately if line breaks; provide safe, unattended operation round-the-clock during peak demand periods.

Investigate the money-saving, efficiency-boosting advantages of Foxboro Automatic Control for *your* operation. Write for information. **The Foxboro Company, 266 Norfolk St., Foxboro, Mass., U.S.A.**

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TELETAX
TELEMETERING

To order these helpful booklets check the reply card opposite page 38.

Manual on Filter Bed Agitators

206. General information-specifications and installation data regarding the application of Palmer agitators, or rotary surface wash in vertical and horizontal pressure filters—round, square and rectangular open gravity type filters are covered in Manual from Palmer Filter Equipment Co., 822 East 8th St., P. O. Box 1696, Erie, Penna. Check the reply card.

Complete Catalog and Reference Data on Valves and Fittings

211. The entire M & H line of valves, fittings and accessories for water works, filtration, sewage disposal and fire protection are illustrated and fully detailed in Catalog 52 issued by M & H Valve & Fittings Co., Anniston, Ala. In addition to complete data on these products, there are many pages devoted to helpful engineering data. Every designer should have a copy.

Manual on Pipe Finding Techniques

213. A manual on special pipe finding and leak detecting techniques of interest to utilities, municipalities, oil and gas companies is announced by Fisher Research Laboratory, Inc., 1961 University Ave., Palo Alto, Calif. The manual contains a number of articles on locating buried pipes and cables and detecting and locating fluid leaks in pipe lines.

Catalog on Dewatering Pumps

226. Centrifugal and diaphragm pumps for dewatering jobs are described in Catalog DP7 from The Jaeger Machine Co., 550 West Spring St., Columbus 16, O. Models, specifications and performance tables are included. Check the reply card.

Manual on the Hersey Disc Water Meter

329. Illustrations, descriptions and specifications of Hersey water meters are covered in manual available from Hersey Mfg. Co., 250 Elm St., Dedham, Mass. Size ranges are ⅝"-¾"x¾"-¾" and 1". Check the reply card.

Technical Bulletin on Swimming Pool Filtration Equipment

335. A 24-page technical Bulletin 626, designed to help persons planning pools which must comply with local and state health regulations, is now available from the R. P. Adams Co., Inc., 328 East Park Drive, Buffalo 17, N. Y. Check the reply card for data on size selection charts, typical installations and drawings.

Concrete Admixtures and Joint Sealers

346. Retarding and accelerating densifiers for concrete and mortar, coatings for exposed aggregate concrete, non meltable mastic waterstops and quicksetting products are covered in 8-page bulletin available from Sika Chemical Corp., 29-49 Gregory Ave., Passaic, N. J.

How to Get Peak Water Production From Your Well

355. Well casings are a vital part of peak water production from wells as well as hiring a competent well driller. Catalog B-15-B from Thompson Pipe & Steel Co., 3025 Larimer St., Denver 1, Colo., covers in detail all types of well casings and their installations. Check the reply card.

Information on Boring Machines

365. General operating instructions for the Earthworm boring machine, a portable compact unit for underground installation of pipe and conduit are available in new bulletin just released by Earthworm Boring Machine, Inc., P. O. Box 1100, Santa Monica, Calif. Suggested procedures for installing pipe or conduit and a price list are included.

Remote Supervisory Pump Operation

405. Bulletin RTM describes remote supervisory pump operation by using telephone lines for communication circuits. Write Healy-Ruff Co., 2255 University Ave., St. Paul 14, Minn., or check the reply card for data on this unit for water and sewage works.

Reference Bulletin Showing Treatment and Correction for Masonry Construction

357. Maintenance problems of masonry construction are covered in this 20-page bulletin from Standard Dry Wall Products Inc., New Eagle, Pa. Check the reply card for this complete and concise bulletin.

How to Clean and Develop Water Wells

375. The use of Weltone, which combines the cleaning power of Calgon with disinfecting and other chemicals in a safe, highly soluble powder is described in an interesting and informative booklet. For your copy of this descriptive literature write Calgon, Inc., Hagan Bld., Pittsburgh 30, Pa. or check the reply card.

What You Should Know About Venturi Tubes and Nozzles

400. A comprehensive bulletin, No. 100, of interest to all engineers dealing with the measurement of liquid flow and its various ramifications has been issued by Simplex Valve & Meter Company, Lancaster, Pa. Data on advantages, construction and installation details, range of sizes and specifications are given in simplified form.

Transite Pipe for Water Systems

447. The installation, operation and maintenance economies of Transite[R] pipe and the Ring-Tite[R] coupling for pressure water lines are described and illustrated in literature offered to engineers from Johns-Manville, 22 East 40th St., New York 16, N. Y. Check the reply card for tables of weights, sizes and pressure classes.

American Ductile Iron for Pipe, Tubing, Casing and Fittings

463. A 36-page illustrated catalog that describes the complete line of American Ductile iron products is available from American Cast Iron Pipe Co., P. O. Box 2603, Birmingham 2, Ala. Check the reply card for technical data including grades, specifications, dimensions and weights, uses and applications.

A new concept for **safe**

HIGHWAY MOWING!

MOTT Hammer-Knife mowers! One mower for all hi-way mowing jobs . . . rough or smooth—grass or weeds—wet or dry! The in-line cutting action is in the direction of travel. It cuts evenly —without scalping—through ditches, over banks and along roadways. The unique flail-type cutting action deflects the shredded clippings to the ground—not even a blade of grass is tossed sideways. There's no danger of flying sticks, stones and other debris. MOTT *is* safe . . . safe to operator and safe to passing traffic.

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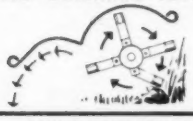
MOTT is low in operating costs and maintenance cost. Proven in actual use to stand up under the most rugged hi-way mowing conditions. The free-swinging knives can be sharpened repeatedly and eventually replaced at dime store prices. 32 models from 18 in. to 19 ft. New type 13 ft. convertible gang hitch shown. Also available in standard rear or underslung mountings—4, 5 or 6 ft. widths.

We invite you to try the MOTT Hammer-Knife mower under your own mowing conditions—then compare! Seeing is believing. See your local dealer—or write for complete literature.

EVEN CUT ON ALL TERRAIN

SAFE--DOWNWARD CUTTING



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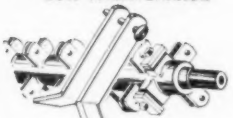

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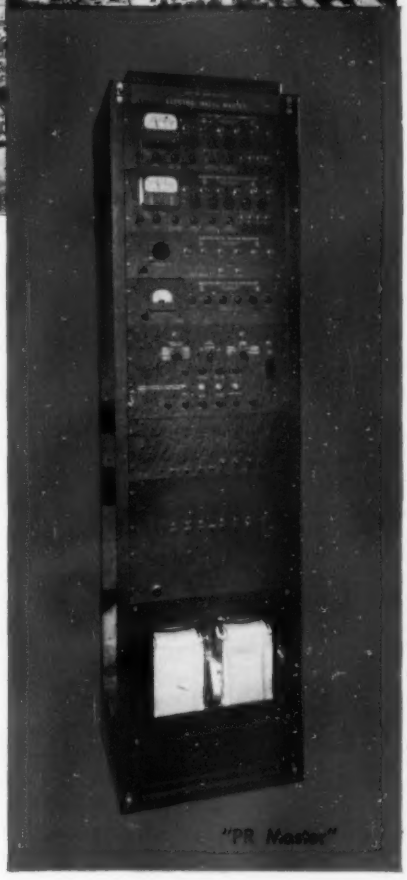
SAN ANTONIO LOOKS TO 1970....
with its NEW Traffic Signal System



153 intersections now controlled by
ELECTRO-MATIC® PR SYSTEM

Handling today's traffic is difficult enough, but to provide signal controls for expected 1970 traffic volumes is a major accomplishment. San Antonio did just that. They selected a flexible, versatile system that not only puts an end to downtown traffic snarls but insures movement of maximum volumes in the years to come.

An ultramodern all-electronic "PR" System controls 153 intersections in the heart of vital, growing San Antonio. All changes in volume and direction of traffic are constantly recorded and the most effective signal indications automatically computed and put into effect smoothly and without delay.

For details on how the PR System can help your city grid or arterial traffic, write for Bulletin No. E-224.

"PR Local"

TRAFFIC ACTUATED

AUTOMATIC SIGNAL DIVISION
EASTERN INDUSTRIES, INC.
NORWALK, CONNECTICUT

To order these helpful booklets check the reply card opposite page 38.

U. S. Tyton Joint Pipe

490. An eight page booklet on centrifugally cast, Tyton Joint pipe for water or other liquids has been announced. The newly developed Tyton Joint is simple, sturdy and tight. Illustrations show details of joint and method of assembly. Write U. S. Pipe & Foundry Co. Birmingham 2, Ala., or check the reply card.

Copper Sulfate In Control of Microscopic Organisms

529. This valuable 52-page manual on the use of copper sulfate in the control of microscopic organisms in water supplies is available from Phelps Dodge Refining Corp., 300 Park Ave., New York 22, N.Y. Covered are organisms, odors, methods of using copper sulfate, calculation tables and table showing chemicals required for treatment of different Genera.

Badger Read-o-Matic Register For Outside Water Meter Reading

536. The Read-o-Matic is simple to install and requires no outside power. Doorbell-type wire carries the pulse from generator in meter to the register on the outside of the building. Check the reply card or write Badger Water Meters, 4545 West Brown Deer Road, Milwaukee 18, Wisc.

Modern Elevated Water Tanks

566. A 16-page bulletin describing 2 types of water storage tanks, the watersphere and the waterspheroid, is available from the Chicago Bridge & Iron Co., 332 South Michigan Ave., Chicago 4, Ill. Standard sizes from 25,000 gals. to 500,000 gals. are covered.

Standardized Motor Control Centers

581. The Unitrol is designed to meet your specific control requirements by providing full open phase protection with 3-coil overload relays and other features. Check the reply card or write Cutler-Hammer, Inc., Milwaukee 1, Wisc.

Streamlined and Modernized Fire Hydrants

607. Models, dimensions and advantages of the Eddy fire hydrant are covered in bulletin from the Eddy Valve Co., Waterford, N. Y. Check the reply card for complete details.

Caterpillar Engines Supply a Wide Range of Horsepower

616. Caterpillar engines, either diesel or electric, can be supplied in a wide range of standard packages or special assemblies to fit your needs. Write the Engine Div., Caterpillar Tractor Co., Peoria, Ill., or check the reply card for literature on models and specifications.

AWWA Butterfly Valves Custom Built to Specifications

630. Butterfly valves that can be operated by air, oil, water, electrically or manually and are made in standard sizes to 24 ins. are fully described in literature from Fabri-Valve Co. of America, P. O. Box 4352, Portland 8, Ore. Check the reply card for full specifications.

For Prompt Service Use The Reply Card

Water Service Hydrants and Outdoor Drinking Fountains

661. Water service hydrants in 4 sizes, ¾", 1", 1¼" and 2" and all types of outdoor drinking fountains are described in a well-illustrated, 24-page catalog from The Murdock Mfg. & Supply Co., 426-30 Plum St., Cincinnati 2, O.

Mueller Drilling, Tapping and Inserting Machine

696. The Mueller B-100 double pressure chamber tapping machine makes faster taps, assures pressure tight connections and can be used by hand or with power. Check the reply card or write Mueller Co., Decatur, Ill.

Turn Your Water Meter Reading Inside-Out

671. The Visi-Meter is a remote recording and indicator system that eliminates the need of entering the home to read water meters. It records within an accuracy of 0.1 percent. Check the reply card or write Visi-Meter, Inc., 301 North 17th St., Kansas City, Kans., for literature.

Electronic Locators for Water Mains, Services, Valves and Boxes

677. Miniaturized line locator that is encased in a molded glass fibre container and has transistors that have a rated life of 70,000 hours and weighs only four lbs. when completely assembled is described in literature from Wilkinson Products Co., 3067 Chevy Chase Drive, Pasadena 3, Calif. Check the reply card.

Bulletin Covers Step-by-Step Action on the Water Problem

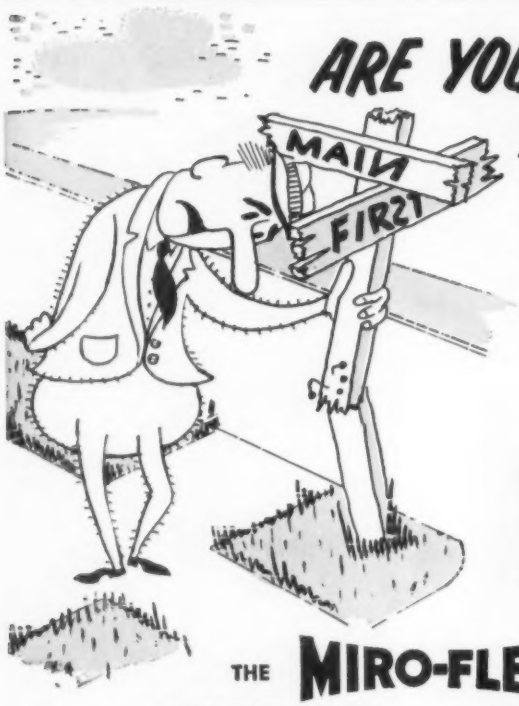
689. A step-by-step outline of action telling how the responsible citizens can help their officials extend and improve the local water system through more adequate rate structures on financing is covered in this bulletin available from Thos. F. Wolfe, Managing Director, Cast Iron Pipe Research Association, 3440 Prudential Plaza, Chicago 1, Illinois, or by circling the reply card.

Water Filtration Costs Can Be Reduced

692. The "Celite" system of diatomite filtration makes possible reduced installation cost, with space requirements a fraction of those for equivalent sand filtration. For informative literature write Johns-Manville, Box 14, New York 16, N.Y.

Flexible Plastic Pipe For Water Distribution

708. A new-type polyethylene resin flexible pipe is described in Catalog No. 402 available from Orangeburg Mfg. Co., Inc., 375 Park Ave., New York 22, N. Y. Fittings, installation, size and weight tables and physical properties are several of the sections covered.



ARE YOU PROUD OF YOUR STREET NAME SIGNS?

Do your street-name signs reflect the pride of your community, and do they stand out so everyone can tell where they are? Uniform Miro-Flex Street-Name Assemblies can set you on the right track – and keep you there, even on a limited budget. There is a complete assortment of styles from which to choose, and all of them are embossed for long life – giving maximum strength, rigidity, and legibility. Send for your free copy of the Miro-Flex sign catalog and the name of your nearest source.

Embossed
MIRO-FLEX SIGNS ARE THE PRIDE OF ANY COMMUNITY...

THE MIRO-FLEX CO., INC.
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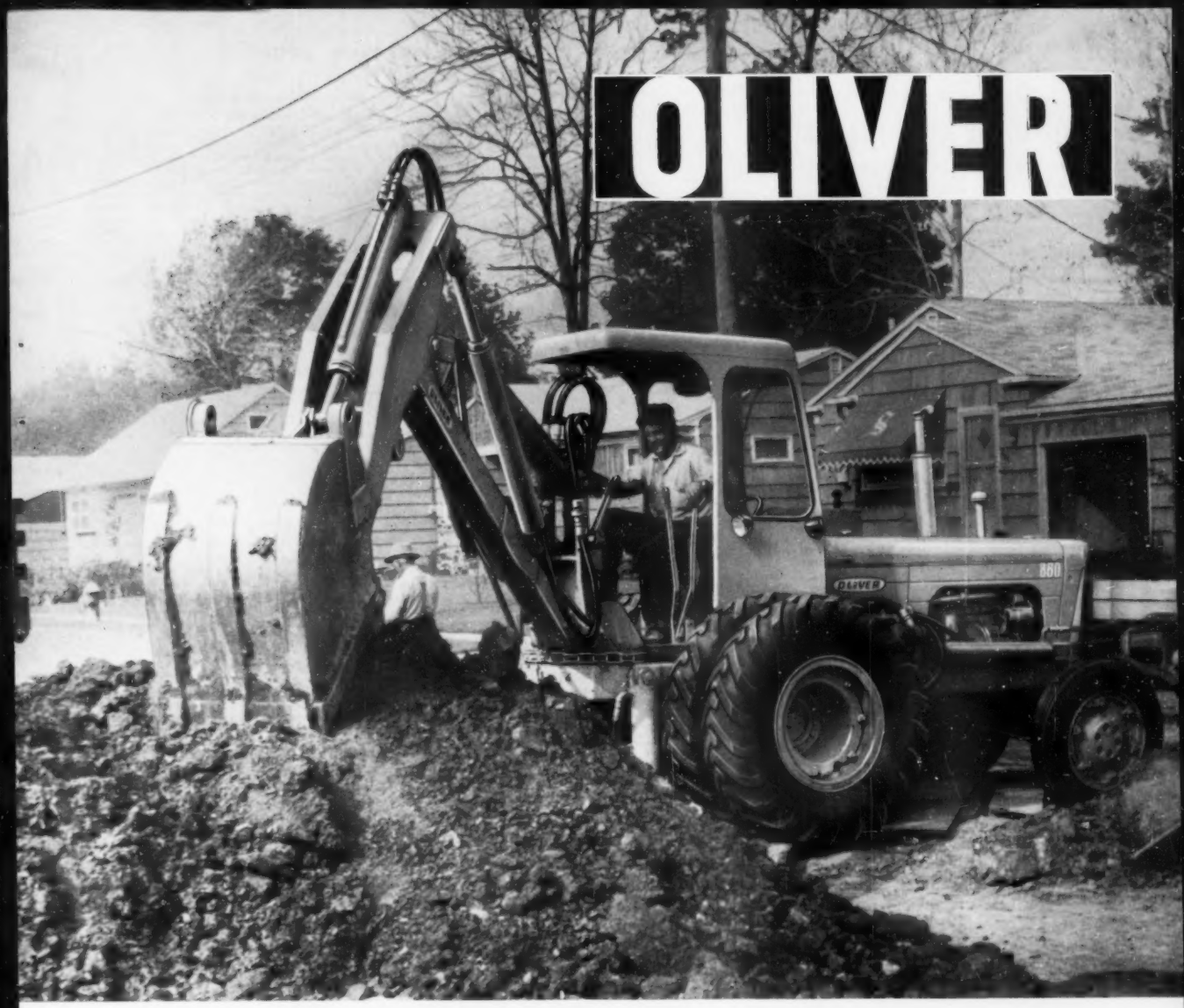
Standard Traffic Signs Available for Immediate Delivery at Northeastern Warehouse
Koontz Equipment Corporation, 325 Ohio River Blvd., Emsworth, Pittsburgh 2, Pennsylvania

To order these helpful booklets check the reply card opposite page 38.



75% PRODUCTION BOOST WITH OLIVER 80-HT

—says New York contractor

The Oliver 880 tractor can also be equipped with a factory-matched 1-yd. bucket—making it a true heavy-duty loader. This unit is highly mobile, with travel speeds from 2 to 17 m.p.h. Gas or diesel power.

When this Oliver Model 80 Hydro-Trencher "took over" the job of digging 50-foot laterals in the rocky shale of Staten Island, Patsy Iaizzo, local contractor, happily noted two important benefits: 1. An immediate 75% increase in production over any of the three trencher combinations that he had been using. 2. A saving of at least $90 per month in fuel alone.

Savings like this are common among owners of this combination —the Oliver 880 tractor equipped with the Model 80 trencher. The ½-yd. bucket digs and loads to 12 feet. The boom swings 180° and the dual-circuit hydraulic controls allow raising or lowering the bucket while swinging. Result: faster work cycles. Now municipalities, utilities and contractors can rip out pavements, dig in hardest soils (even frozen ground)—and do these jobs with a unit that can travel anywhere on busy streets.

Your dependable Oliver distributor will gladly demonstrate—on your job. Call him today or write for literature.

OLIVER **THE OLIVER CORPORATION**

Industrial Division, 19300 Euclid Ave., Cleveland 17, Ohio

a complete line of industrial wheel and crawler tractors and matched allied equipment

SEWERAGE AND WASTE TREATMENT

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay under drain blocks conforming to ASTM standards, suggestions for layouts and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute c/o Editor, Public Works, 200 So. Broad St., Ridgewood, N. J. Check the reply card and we will forward your request.

Helpful Design Data For Sewage Ejectors

81. The application and advantages of pneumatic sewage ejectors are outlined in bulletin S-55 of the Blackburn Smith Mfg. Co., Inc., Hoboken, N. J. Included are piping diagrams for electrode and float switch controls plus dimensions and layouts for single and duplex systems.

Automatic Engine Control Equipment Manual

83. This catalog contains descriptions of standard automatic and semi-automatic controls and control equipment. General control recommendations, control selection chart, accessory selection chart, safety stop controls and alarm sets are sections covered. For price lists and models available write Synchro-Start Products, Inc., 8151 N. Ridgeway, Skokie, Ill.

Sealed Electrode Floatless Pump Controller

99. The floatless pump controller is a valuable accessory for sewage and drainage sump pumps for it is never affected by corrosive elements, has no moving parts and cannot become coated with grease, oil or soap. For design data and specifications write Food Machinery and Chemical Corp., Chicago Pump Co., 622 Diversey Parkway, Chicago 14, Ill., or check the reply card.

Theory of Controlled Digestion With Floating Cover Tanks

88. In an excellent 40-page booklet, an authoritative discussion of digestion theory and practices, including design, operation and economics is presented by the Pacific Flush Tank Co., Chicago 13, Ill. Complete data are given on the use of floating covers, together with details on tank construction, piping and control chambers.

Get Data Now on This Catch Basin Cleaner

198. Simple powerful pneumatic bucket is featured by Netco Catch Basin Cleaner. Folder 33A gives details and illustrates operation of complete self powered truck mounted unit, Netco Div., Clark-Wilcox Co., 118 Western Ave., Boston 34, Mass. Check the reply card.

Dependable Engines for Sewage Treatment Plants

227. Climax Sewage Gas Engines are available for continuous duty operation to drive pumps, blowers or generators in a range of sizes from 40 to 250 HP. Use the handy reply card to obtain complete details and literature from Climax Division, Waukesha Motor Co., Box 379, Waukesha, Wisc.

Manual on Coatings to Stop Rust

235. Primer type, short oil type, heat resistant, chemical resistant and floor coatings are a few of the items covered. Also complete data on Rust-Oleum products are included. Check the reply card or write Rust-Oleum Corp., Evanston, Ill., for this valuable manual.

Complete Story of Rubber as a Coupling Medium in Pipelines

295. "Joint Enterprise", a booklet describing Tylox rubber joints for coupling pipe used in sewerage, drainage and waterworks projects is now available from Hamilton Kent Manufacturing Co., 7 West Grant St., Kent, Ohio. The booklet also contains illustrated case histories of Tylox-Jointed installations, and suggestions to assist engineer in specifying Tylox joints for both tongue and groove, and bell and spigot pipe. Check the reply card.

Valuable Information on Underground Pumping Stations

246. The complete prefabricated underground pumping station is fully described in a bulletin just released by Zimmer & Francescon, 1715 Fifteenth Street Place, Moline, Ill. Construction features, corrosion control, electric controls, specifications, pumping equipment and installation are a few of the items covered. Check the reply card.

Chapman Standard Sluice Gates

276. Manual, hydraulic or electric motor control sluice gates are described fully in Catalog 25 available from The Chapman Valve Mfg. Co., Indian Orchard, Mass. These valves are easy to replace and are fitted without alterations. Check the reply card.

Pneumatic Sewage Ejector Pumping Systems for Low Flows

317. Dimension and capacity tables for pneumatic float or electrode controlled ejectors, cast iron or welded steel, covering flow ranges of 20 to 600 gpm, including all information necessary in design are given in Bulletin No. KSM-2 3/58. Check the reply card or write Komline-Sanderson Engineering Corp., 101 Holland Avenue, Peapack, N. J.

Centrifugal and Turbine Type Pumps For Water and Sewage Plants

321. Turbine-type pumps, close or flexible couple drive, and end suction centrifugal pumps and mixed flow pumps are described in Catalog M available from Aurora Pump Div., The New York Air Brake Co., 636 Loucks St., Aurora, Ill. Included is a pump selection guide and spigot pipe. Check the reply card.

Diesel Engines For Municipal Power Needs

359. Dependable power for water supply or flood control pumping stations, stationary or portable electric plants and many other municipal needs can be provided by engines described in literature of the Enterprise Engine & Machinery Co., 18th & Florida Sts., San Francisco 10, Calif.

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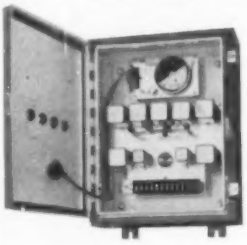
PUMP CONTROLS

FOR GASOLINE, DIESEL & GAS ENGINES



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Synchro-Start's Program timer control can be PRESET for the LENGTH OF TIME, TIME OF DAY OR NIGHT and the DAYS OF THE WEEK the engine is required to RUN, as well as the time it is to be stopped.

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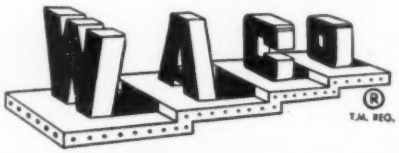

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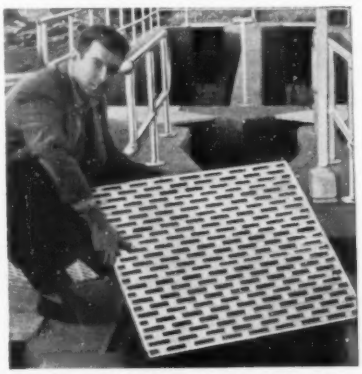

George H. Hill, Washington Aluminum's New England representative, points out the grating's patented perforation pattern.

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High-capacity, internally-driven hydraulic pump operates heavy-duty International Wagner backhoe and loader. Backhoe trenches to grade, as deep as 13¼ feet.

THE HUSKY NEW INTERNATIONAL® 460 UTILITY DELIVERS

real bite at the backhoe bucket!

What a power house for high capacity trenching and loading!—look at the score card:

Typical operating weight of 5,015 pounds*—3,185 on the rear wheels—means built-in brawn that lets the big backhoe cylinders go all-out to bite fast and clean in tough-to-dig materials. It means built-in *stamina* for less downtime, higher production, *lower cost per cubic yard* of materials handled!

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**With 175-lb operator, but no added weight or mounted equipment.*

Ask your IH Dealer to demonstrate the 61 hp† 460 Utility, or the other 5 sizes in the International line, 12.8 to 90 bare engine hp†. For name of IH dealer and new catalog, write International Harvester Company, Dept. PW-6, P.O. Box 7333, Chicago 80, Illinois.

†Bare engine hp at standard sea level conditions.

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International Harvester Company products pay for themselves in use—Farm Tractors and Equipment . . . Twine . . . Commercial Wheel Tractors . . . Motor Trucks . . . Construction Equipment—General Office, Chicago 1, Illinois.

Heavy-duty International Wagner loaders are available with either conventional or self-leveling bucket control. Big, ⅝-cu yd materials bucket can be interchanged with rotary broom, fork lift, etc.

For faster loading and other shuttle-type work, the new 460 Utility can be equipped with Fast Reverser unit, providing a reverse speed in each forward gear, each 22 per cent faster than the forward speed.

To order these helpful booklets check the reply card opposite page 38.

Water, Sewage and Industrial Waste Treatment Equipment

410. Catalog 2617 gives descriptions of the various items of sanitary engineering equipment made by Link-Belt. Check the reply card or write Link-Belt Co., Colmar, Pa., for details on screens, grit collectors, mixers, feeders and sludge collectors.

Getting Improved Sludge Dewatering With Non-Clogging Vacuum Filters

425. Latest information on the Komline-Sanderson "Coilfilter," which features non-clogging, permanent filter media to obtain constant output and low operating cost is presented in illustrated Bulletin No. 106 by the Komline-Sanderson Engineering Corp., Peapack, N. J. Be sure to investigate this improved method of sludge dewatering. Check the reply card today.

Fischer & Porter Magnetic Flowmeter Catalog

436. Catalog 10D1416 gives complete data on F & P obstructionless magnetic flowmeter for metering waste sludges, sewage and slurries. Principles of operation and advantages are covered. Check the reply card or write Fischer & Porter Co., 38 Jacksonville Rd., Hatboro, Pa.

Valuable Information on Incinerator Stokers

505. The Combustion Engineering stoker is described fully in Catalog No. IS-1 which is available from Combustion Engineering, Inc., Combustion Engineering Bldg., 1132 W. Blackhalk St., Chicago 22, Ill. Schematic drawings of the units, advantages of incineration, firing methods, design and performance are sections covered. Check the reply card today.

Gas and Gasoline Engines Described in Literature

535. Roiline engines (formerly LeRoi), gas and gasoline models are built as bare engines, complete power units, and with components and accessories for special services. Check the reply card or write Waukesha Motor Co., Waukesha, Wisc., for details on the use of these engines in compressor, generator and pumping installations.

Equipment for Water, Sewage and Industrial Waste Treatment

549. Catalog 952 contains sections on water and bar screens, grinders, collectors, settling tanks, scum removers, FLOCTROLS, feeders, conveyors and chains and sprockets. Check the reply card or write Advertising Dept., The Jeffrey Mfg. Co., Columbus 16, Ohio, for drawings, charts and installation photographs of all the equipment.

4-D Wrought Iron for Building Drainage Systems

551. A comprehensive 64-page catalog on piping for soil, waste, vent and downspout applications is available from A. M. Byers Co., P. O. Box 1076, Pittsburgh 30, Pa. Check the reply card for corrosive conditions, typical installation, performance tables and piping economy.

Dorr Clarifier for Rapid Sludge Removal

577. A 4-page, two color Bulletin No. 6193 entitled "The Dorr SR Clarifier" describes the design features and advantages of this new final unit for continuous, rapid sludge removal. Check the reply card or write Dorr-Oliver Inc., Havemeyer Lane, Stamford, Conn., for installation photos, line drawings of the unit and a chart of design data.

Weinman Horizontal Non-Clog Centrifugal Pumps

579. Non-clog pumps for sewage and sludge in municipal plants are covered in literature from the Weinman Pump Mfg. Co., 290 Spruce St., Columbus 8, O. Specifications and dimensions are included.

Catalog on Selecting Equipment For Water-and-Waste Treatment

718. Cross-indexed for quick, easy reference to equipment, trade names and applications, this 32-page catalog covers all major equipment in the complete Infilco line. Write for Bulletin 80 to Infilco Inc., P. O. Box 5033, Tucson, Ariz., or check the reply card.

Vertical, Close-Coupled Sewage Pumps

548. Bulletin on vertical, close-coupled "Non-clog" sewage pumps contains suggested specifications and details of design. Check the reply card or write Smith & Loveless, Inc., P. O. Box 8884, Kansas City 15, Mo.

Specifications on Trash-Sewage Pumps

599. Complete specifications, drawings, performance curves and the applications of Gorman-Rupp trash-sewage pumps are covered in literature from The Gorman-Rupp Co., Mansfield, Ohio. Check the reply card.

Odor Control Treatments for Sewage Plants and Storm Sewers

646. Poly-cide odor control treatments have been successfully used by municipalities in eliminating obnoxious odors from sewage plants, storm sewers, garbage and rubbish trucks, refuse cans and public rest rooms. Write Brooks Chemicals, Inc., 3304 E. 87th St., Cleveland 27, Ohio, or check the reply card for literature.

Full Line of Sewer Cleaning Equipment

681. Everything for rodding sewers from hand operated equipment to the fully mechanized SeweRodeR. Tools for all types of stoppages are operated by Flexicrome Steel Sewer Rods. Featuring the Truck-Loder which dumps sewer deposits directly into truck, a complete range of Bucket Machines is offered. All equipment is described in 48-page Catalog 55-A. Flexible, Inc., 3786 Durango Ave., Los Angeles 34, Calif.

Simplify and Save on Public Works Electrical Construction

710. Information and literature is available from Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa., on how you can simplify electrical details of a public works project. Westinghouse field specialists will help you plan the electrical system to fit your need. Check the reply card.

COST SAVING TRUCK CRANE for UTILITIES and GOVERNMENT AGENCIES

the HIAB 170

one man operated — fully hydraulic

Here's a LOW COST, versatile, fully hydraulic, one-man operated truck crane that's an ideal tool for utilities and government agencies. Write for the names of current users. The HIAB 170 offers a range of lifting capacities from 6,000 lbs. on the shortened boom of 5' to 2500 lbs. on a full boom of 13'. The boom length is easily adjustable through hydraulic control.

An efficient general utility tool for maintenance work, the HIAB 170 will lift up to 20' above ground level at a maximum speed of 20" per second. Control is from either side of the truck cab. Crane action is positive and accurate. 200° or 360° swing arc. When not in use the HIAB 170 folds snugly behind the cab, taking only 15" of space. This leaves the entire truck bed open for load. Also available is the HIAB "Bimbo" Model 290—a smaller version of the HIAB 170, with the same design features.

San Diego Gas & Electric Company finds the HIAB 170 a time-saving tool.

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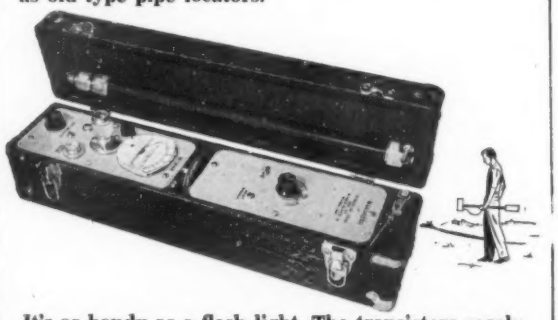
THE NEW MINIATURIZED WILKINSON LINE LOCATOR MODEL W-3

This radically new, powerful, transistorized locating instrument weighs only 4 pounds and is ¼ as large as old type pipe locators.



It's as handy as a flash light. The transistors rarely, if ever, require replacement; non-leak mercury cells outlast old type batteries at least ten times. The instrument cases are molded glass fibre. The aluminum connecting handle telescopes to 17 inches, and the entire instrument comes in a substantial carrying case.

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NOW...

cut new filtration plant costs 45%

Increase clear water capacity 100%

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You can now double the potable water capacity available to your growing community and cut the installation cost of new filtration nearly in half. How? Specify diatomite filtration. You'll reduce land and construction costs because diatomite systems need only ¼ the housing space of equivalent-capacity sand plants. In fact diatomite systems are so compact, they can sometimes be added to existing plants.

If you're considering water filtration for the first time, it makes good financial sense to go Celite* diatomite all the way. An actual test installation by Johns-Manville has proved that a diatomite filter station can be installed for 45% less than a sand filter station of equal capacity.†

What's more, Celite will usually give better water clarity under comparable conditions. Turbidity is far lower. More suspended solids, including all floc, amoebae and algae, are removed. And a Celite diatomite system is easily operated and maintained by regular municipal water personnel.

Mined from the world's purest commercially available deposit, Celite is carefully processed for complete uniformity. Call your nearby Celite engineer for complete information on Celite's wide range of grades; he will gladly assist with your particular problems. And write today for FREE informative reprint.† Johns-Manville, Box 14, New York 16, New York. In Canada, Port Credit, Ontario.

*Celite is Johns-Manville's registered trade mark for its diatomaceous silica products.

†Comparison Studies of Diatomite and Sand Filtration by G. R. Bell, Journal American Water Works Association, September, 1956.

JOHNS-MANVILLE JM PRODUCTS

To order these helpful booklets check the reply card opposite page 38.

CONSTRUCTION EQUIPMENT AND MATERIALS

For Fast, Smooth Pipe Cuts

68. Descriptive literature on the Reed 4-wheel hinged pipe cutter which operates in close quarters, gives quick, easy right-angle cuts, and is available from Reed Mfg. Co., Erie, Pa. Check the reply card.

Useful Attachments for "Payloader" Tractor Shovels

95. Increased versatility for Hough "Payloader" tractor shovels is made possible by the various attachments described in literature of the Frank G. Hough Co., 761 Seventh St., Libertyville, Ill. Illustrated and described are rotary "V" and trip-blade snow plows, hydraulic backhoe, back-filler blade, pickup sweeper, scarifier teeth, winches, etc.

Data on Portable Hydraulic Earth Borer

138. Complete specifications on the Holan hydraulic earth borer are available from J. H. Holan Corp., 4100 West 150th St., Cleveland 11, Ohio. Check the reply card for literature.

A Fully Rotary Compressor by Jaeger

209. Complete information is available from The Jaeger Machine Co., Columbus 16, Ohio on this 2-stage, oil-cooled rotary compressor. Features include 80% fewer moving parts, up to 30% less weight, vibrationless operation and 100° cooler air.

Austin-Western Construction Equipment Catalog

260. Power graders, street sweepers, road rollers, crushing and screening plants and hydraulic cranes are covered in catalog from Austin-Western, Construction Equipment Div., Baldwin-Lima-Hamilton Corp., Aurora, Ill.

Modern Compaction Methods and Equipment

290. This 52-page Manual covers modern day compaction methods and equipment, rubber-tire rolling, compaction of asphalt mixes, aspects of vibratory compaction, stage compaction on cohesive soils and compaction of asphaltic concrete surfaces. Check the reply card or write Road Machinery Div., Bros Inc., 1057 Tenth Ave., S. E., Minneapolis 14, Minn., for your copy.

Booklet Shows Design of Pre-Engineered Steel Buildings

271. Pre-engineered Butler steel buildings are available in every size, type and design to meet your buildings needs. In a helpful 16-page booklet you will find details on several basic designs and an unlimited variety of door, window and interior treatments; answers to your questions on construction and erection; and many illustrations of typical uses. Write to Butler Mfg. Co., Kansas City, Mo.

Davis Back-Hoe and Davis Loader

312. Literature is available from Massey-Ferguson Industrial Division, Massey-Harris-Ferguson, Inc., 1009 S. West St., Wichita, Kans., describing the new Davis backhoe and Davis loader. The back-hoe can dig at right angles and to a depth of 13 ft. and detaches in 5 minutes. Both units are available for most popular makes of tractors.

Complete Line of Shovels, Draglines, Cranes and Clamshells

361. Bucyrus-Erie crane-excavators in sizes from ⅜ to 4 cu. yd. capacities are covered in literature from Bucyrus-Erie Co., South Milwaukee, Wis.

Portable Water Coolers Used on Maintenance and Construction Work

651. Igloo cans and coolers are permalined and range in capacity from 2 to 15 gals. Models and sizes are covered in bulletin available from Igloo Corp., P. O. Box 8227, Memphis 4, Tenn., or by checking the reply card.

Catalog on Utility Bodies and Equipment

360. General service bodies, line construction bodies, aerial equipment, winch and derrick equipment and trailers are the units covered in this catalog. For design, dimensions, illustrations and descriptions check the reply card or write McCabe-Powers Auto Body Co., 5900 N. Broadway, St. Louis 15, Mo.

IHC Crawler Tractors For Highway Construction

491. Information on the new International TD-6, TD-9, TD-14 and TD-18 diesel crawler tractors is contained in 8-page, 2-color booklets available from Consumer Relations Dept., International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill. Mechanical features and specifications, engine power, and operation are fully covered.

Portable Water Coolers For Every Need

526. Water cooler sizes range from 1½, 2, 3, 5, 10, 15, 20, 25 and 30-gal. and are used on highway construction and maintenance and where-ever outside work is done. Check the reply card or write Horton Equipment Co., P. O. Box 2611, Houston 1, Tex.

Vertical Augers and Horizontal Diggers For Construction Work

644. Prewitt diggers are 2 types, a horizontal boring machine for tunneling work and a vertical rig for pole or post holes, digging up to 6½ ft. Check the reply card or write to J. R. Prewitt and Sons, Inc., Dept. 508, Pleasant Hill, Mo., for full details.

Slide Rule PS1 Calculator For Concrete

713. A new pocket size slide rule calculator for the testing of concrete in compression is available from Forney's Inc., P.O. Box 310, New Castle, Pa. It is designed to convert instantly the pressure applied to concrete cylinders and blocks into psi.

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rugged as the men who use them

IGLOO leads in water cooler sales because it's stronger, lasts longer. IGLOO will keep more men on the job more of the time. When you order water coolers, specify IGLOO. Available in 2, 3, 5, 10 and 15 gallon sizes.

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with the cost-cutting help of this new JOHN DEERE LOADER-BACKHOE

Here's the outfit that's making a lot of cost figures obsolete—giving many municipalities a welcome break on construction expenses.

The reasons are low first cost and outstanding fuel economy, plus consistently high work output.

Self-leveling, the new 831 Loader gets the 7/8-yard heaped load into the truck fast—and with a minimum of effort. When bucket is dumped from full height, it returns to digging angle by use of the *boom-control only*. A 35-degree bucket roll-back provides the heavy pry-out needed for full loads.

The 51 Backhoe combines 2-lever digging with plenty of power and unusual flexibility. In minutes, one man out on the job can set the boom-mounting to any of five positions from flush left to flush right, using only a wrench.

For details, and a demonstration, see your John Deere Industrial Dealer.

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SPECIALISTS IN LOW-COST POWER WITH A HEAVYWEIGHT PUNCH

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STREETS AND HIGHWAYS

Calcium Chloride For Road Construction and Maintenance

41. Calcium chloride for concrete road construction, for maintenance of unpaved roads and for the control of ice are covered in literature from The Dow Chemical Co., Midland, Mich. Check the reply card.

Concrete Bridge Details

58. An illustrated 48-page booklet, published by the Portland Cement Association, 33 W. Grand Ave., Chicago 10, Ill., calls attention to good and poor practice in bridge building. It also shows how to improve improper details and open the way for use of higher stresses. Write to PCA for your copy or check the reply card.

Chip Dollars from Your Overhead With Fitchburg Chippers

160. Detailed cutaway drawings, specifications, diagrams, charts and money-saving reports and experiences are covered in catalog available from Fitchburg Engineering Corp., Dept. PW, Fitchburg, Mass.

Drilling Machine For Concrete

221. The Truco diamond drilling machine is described in literature available from Truco Masonry Drilling Div., Wheel Trueing Tool Co., 15-3200 W. Davison Ave., Detroit 38, Mich. Unit will cut reinforced or plain concrete.

4-Wheel Drive Tractor Loaders

434. A 16-page Catalog, No. 1033-5-57, describing the "Tracto-Loader Line" of front end wheel loaders is available from Tractomotive Corp., Deerfield, Ill. Covered are the five models that are in production.

DRAMATICALLY CLEAN sweeping with Tennant "100" reduces complaints, attracts public interest.

How to give your city an EXTRA-CLEAN name

From Maine to California, progressive cities take pride in the *cleanliness* of their downtown areas—as these are their public "showcases".

It is here—where extra-clean sweeping counts most—that you will find enthusiastic interest in TENNANT's revolutionary *vacuumized sweeping.*

You'll see the difference at once, because a TENNANT Model "100" Vacuumized Sweeper provides *ultra-clean sweeping . . . with no dust nuisance at all!* For performance, the new "100" is in a class by itself.

Its powerful brush-and-vacuum system picks up the fine dust that's usually missed . . . as well as heavy, bulky debris. It cleans a 7'4" path.

You'll find it trimly compact, highly maneuverable. Assures outstanding results in downtown areas, dusty alleys, parking lots . . . as well as in attractive residential areas.

WRITE TODAY *for illustrated bulletins, photos and performance data. G. H. Tennant Co., 755G N. Lilac Drive, Minneapolis 22, Minnesota.*

TENNANT

VACUUMIZED SWEEPERS

Complete Line of Wheel Tractors in 6 Power Sizes

179. A 16-page catalog CR-1374-H, that describes the 6 IHC wheel tractors from 12 to 72.5 hp. is available from the Consumer Relations Dept., International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill. Special features and specifications for each of these 6 tractors, and a listing of all attachments available.

Rubber Roads Are Now a Reality

230. Ramflex, a free-flowing, devulcanized rubber specially prepared to be used in combination with asphalt for highway paving applications is described in illustrated catalog from U. S. Rubber Reclaiming Co., Inc., P. O. Box 365, Buffalo 5, N. Y. Check the reply card.

Case Utility 310B Backhoe-Loader

282. The Case wheel-mounted backhoe-loader is described and illustrated in 8-page, 3-color Bulletin CUS-110, released from J. I. Case Co., Racine, Wis. Check the reply card for mechanical details of the backhoe, loader and heavy-duty tractor.

From a Stump to Chips in Minutes

303. Pow-R-Stump cutter is operated by one man, handles stumps of any width and up to 33 ins. in height and will not damage curbs, driveways or sidewalks. For literature check the reply card or write Vermeer Mfg. Co., Pella, Ia.

Precast, Prestressed, Pretensioned Concrete Bridges

349. Colorful bulletin, well illustrated, shows the manufacture of Amdek prestressed bridge members. Check the reply card for this helpful bulletin or write Concrete Products Div., American Marietta Co., 101 East Ontario St., Chicago 11, Ill.

Data on Eimco, the Modern Crawler Equipment

358. Front end loaders, dozers, and fork lifts are some of the attachments available for the Eimco tractor. Check the reply card or write The Eimco Corp., Salt Lake City, Utah, for facts and qualified engineering assistance.

Ultra-Clean Sweeping For Streets, Yards and Airports

499. A new approach to extra-clean sweeping is described in a 4-page illustrated Bulletin (No. 85.55) issued by the G. H. Tennant Co., 755 N. Lilac Drive, Minneapolis 22, Minn. Described is a 7'4" path sweeper that eliminates the use of water for dust control. Check the reply card.

Plastic Filament Street Sweeper Pick-Up Brooms

517. Literature is available from Rynal Corp., 114 St. Joseph St., Arcadia, Calif., on plastic filaments for street sweeper pick-up brooms. They are easy to replace, storage space is eliminated and moisture will not attack them.

Data and Specifications on Aluminum Grating Walkways

531. Aluminum walkways for bridges, sewage and water treatment plants and garages are covered in bulletins available from Washington Aluminum Co., Inc., Knecht Ave. & Pennsylvania R. R., Baltimore 29, Md.

Pre-Assembled Dowel Units For Highway and Airport Construction

537. Laclede dowel assemblies for expansion, contraction and construction joints are precision welded into one unit and are maintained in rigid alinement. For full details write Laclede Steel Co., St. Louis, Mo., or check the reply card today.

Vacuum Cleaner and Leaf Collector For Cleaner Streets

595. A unit is now available that can be mounted on a right-hand drive jeep or a pick-up truck for picking up gutter trash and leaves. Complete specifications, capacity, operation and installation procedures are covered in a bulletin available from Tarrant Mfg. Co., Saratoga Springs, N. Y.,

(More listings on page 56)

MORE THAN 2,000 PRESTRESSED CONCRETE WATER TANKS IN SERVICE

In the development of residential and industrial water supply facilities today, no other type of tank offers so many advantages as does the Prestressed Concrete Tank. Modern in engineering and design, proven in service, lowest in cost... prestressed concrete should be considered in any tank planning.

Check these advantages:

- No maintenance required
- Owners never return to other types
- 75% of construction cost spent locally
- Lowest overall cost to community
- Longest service life of any tank

Send for Bulletin T-22

PRELOAD TRADE MARK

THE PRELOAD COMPANY, INC.
211 East 37th Street
New York 16, New York

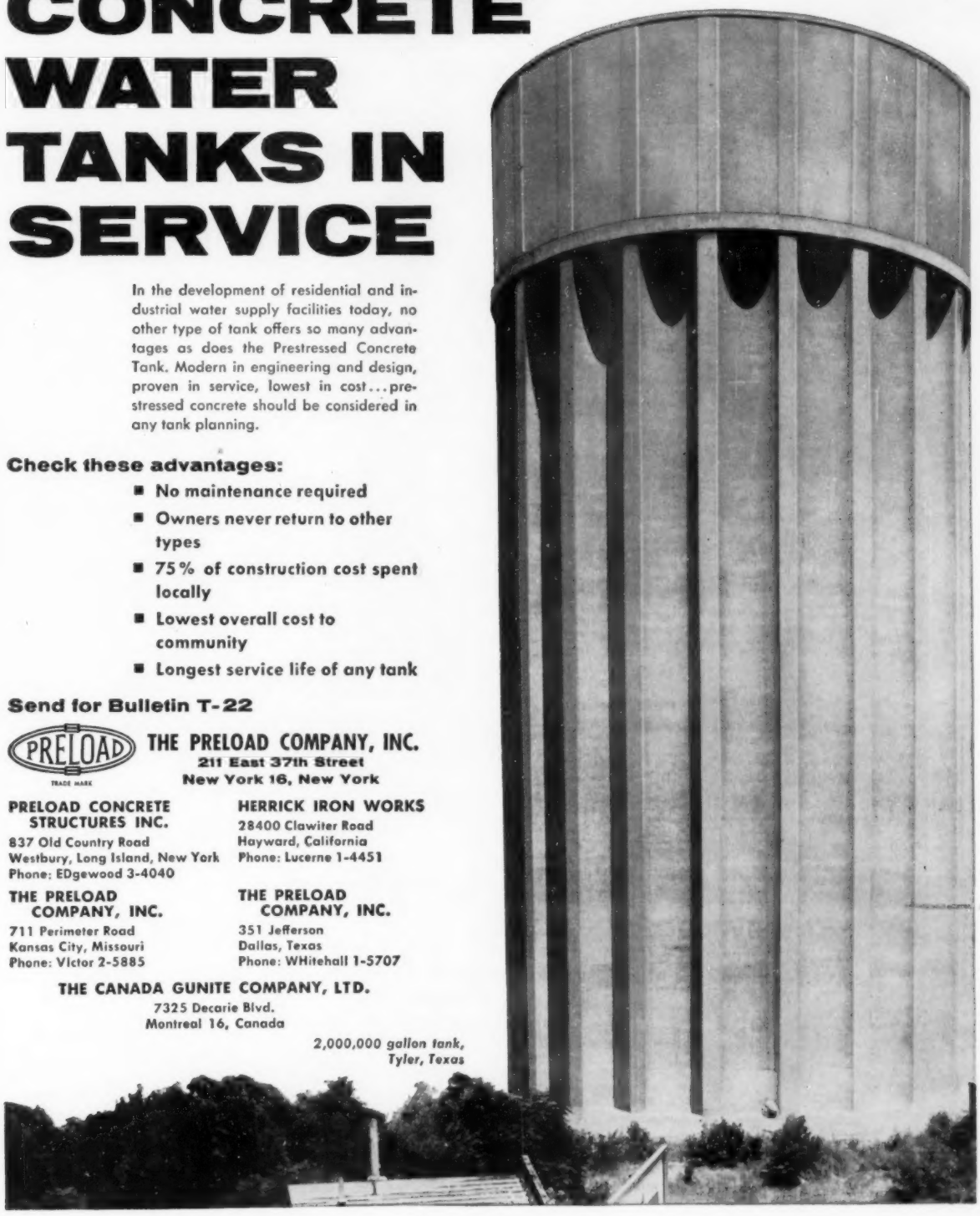
PRELOAD CONCRETE STRUCTURES INC.
837 Old Country Road
Westbury, Long Island, New York
Phone: EDgewood 3-4040

HERRICK IRON WORKS
28400 Clawiter Road
Hayward, California
Phone: Lucerne 1-4451

THE PRELOAD COMPANY, INC.
711 Perimeter Road
Kansas City, Missouri
Phone: Victor 2-5885

THE PRELOAD COMPANY, INC.
351 Jefferson
Dallas, Texas
Phone: WHitehall 1-5707

THE CANADA GUNITE COMPANY, LTD.
7325 Decarie Blvd.
Montreal 16, Canada



2,000,000 gallon tank, Tyler, Texas

CLOW

UNDER WATER

4-man crew lays 1500 feet a day of CLOW 8" Bell-Tite Joint cast iron pipe through Florida swampland—often in 3 feet of water. Hancock Pipe Co., Clearwater, Fla., contractor.

AT 14° BELOW 0

Despite rocky terrain and digging through 2 to 3 feet of frost, workers were able to lay 50% as much 12" Bell-Tite pipe a day at 14 below zero as under normal conditions. Trench was 11 feet deep. Nels Nelson & Sons, Duluth, Minn., contractors.

OR IDEAL CONDITIONS

Laying 2000 feet a day of CLOW Bell-Tite Joint pipe under ideal conditions at Boca Raton, Florida. Reilly-Bates Corp., Pompano Beach, Fla., contractors. Black & Associates, Gainesville, Fla., consulting engineers.

CAST IRON PIPE

PROVED...

CLOW Bell-Tite® JOINT

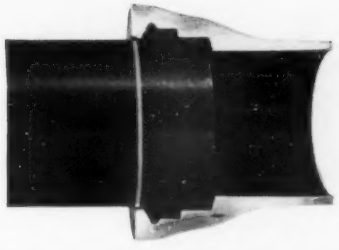
CAST IRON PIPE

saves time and money under all installation conditions

Clow Bell-Tite Joint costs less to buy and less to install. Assembly is easy and rapid and the rate of installation depends only on the speed with which the trench can be excavated.

A single molded rubber gasket is the only accessory required. No bolts, no nuts, no followers, no couplings, no extras to buy. Clow Bell-Tite pipe is available from 3" to 24" in any thickness or weight in accordance with ASA, AWWA, or Federal specifications.

Clow Bell-Tite Joint is easily assembled—just wipe clean, lubricate and push spigot into the bell. When painted yellow stripe is no longer visible, joint is pressure tight.



OUR 81st YEAR
1878 • 1959

It will pay you to know the savings in time and money CLOW Bell-Tite Joint Cast Iron Pipe makes possible. Let us give you complete information on its many advantages.

CLOW CAST IRON PIPE

JAMES B. CLOW & SONS, INC.
201-299 North Talman Avenue, Chicago 80, Illinois

Subsidiaries:

Eddy Valve Company
Waterford, N.Y.

Iowa Valve Company
Oskaloosa, Iowa

To order these helpful booklets check the reply card opposite page 38.

Power Tamper for Granular Soil and Bituminous Surfacing Work

342. The Kelley Power Tamper is a self-propelled unit that is equivalent to a 10-ton roller for backfilling, road widening jobs and compacting around culverts and pipeline trenches. For complete specifications write Kelley Machine Div., Wiesner-Rapp Co., Inc., 285 Hinman Ave., Buffalo 23, N. Y., or check the reply card.

Construction Methods for Salt Stabilized Roads

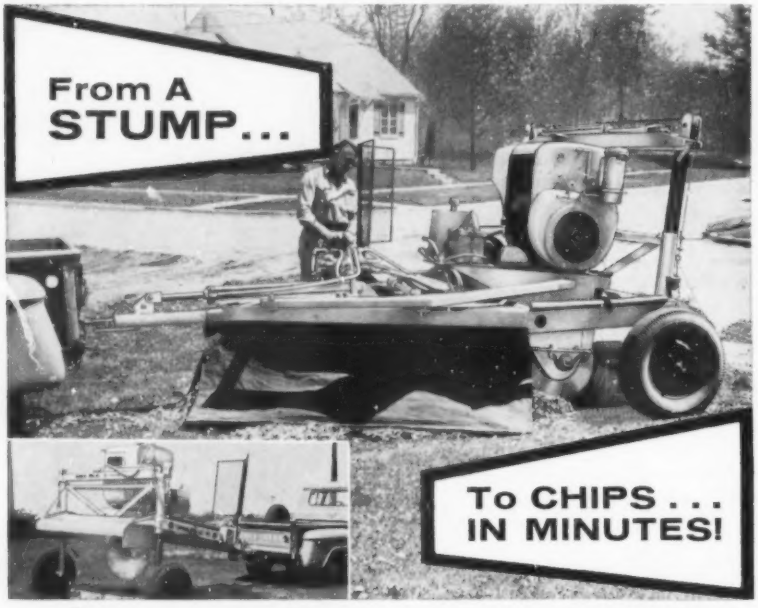
609. A comprehensive booklet showing modern methods of salt stabilization is available from the Morton Salt Co., 110 Nr. Wacker Drive., Chicago 6, Ill. Stabilized secondary roads, base courses and shoulders are discussed and all equipment and construction methods are covered. Just check the reply card for your copy.

Self-Propelled Ditching Machines

438. Information on a self-propelled one man operated ditching machine, model 524 T, model W-2 and a new midget ditcher, model 4 T, for light construction is now available from the Vermeer Mfg. Co., Pella, Iowa. The Model 524 T digs 8 to 24 inches wide and down to 6 feet deep, while the model 4 T digs 6 to 14 inches wide and down to 4½ feet deep. Model W-2 Ditcher digs from 2" wide up to 4" down to a depth of 30". Full data on these ditchers available by checking the reply card.

Highway Mowing with the Mott Hammer-Knife

625. One mower for all highway mowing jobs whether rough or smooth, grass or weeds, wet or dry. Check the reply card or write Mott Corp., 4009 Eberly Ave., Brookfield, Ill., for literature.



Vermeer **POW-R-STUMP CUTTER**

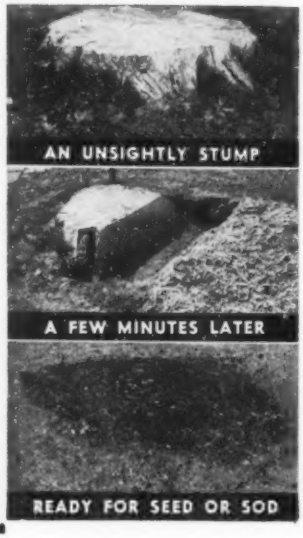
Removes Stumps in Minutes—Not Hours!

Tree Service men and park, recreational and municipal officials all over the country are praising the Vermeer POW-R-STUMP CUTTER. More than an unusual new machine, the Vermeer POW-R-STUMP CUTTER is a revolutionary, new *principle*, that once and for ever has taken the cost, the time and the drudgery of labor out of stump-removal! "From a stump to chips . . . in minutes," is more than a by-word, too, it's a fabulous fact. The Vermeer POW-R-STUMP CUTTER removes the largest tree stump—rips it to shreds to a depth of ten inches below the surface of the ground—all in a matter of minutes. One man, only, is required for the whole operation. And when the job is done there's no stump left to be hauled away, no gaping hole to be filled, no rutted lawns, no damaged curbs, driveways or sidewalks.

This is just part of the remarkable story about the Vermeer POW-R-STUMP CUTTER. To get all the details, write—today—for the colorful new FREE folder, just off the press.

THE ORIGINAL STUMP CUTTER
FIRST & FINEST IN THE FIELD

VERMEER MFG. CO.
1439 W. Washington Pella, Iowa



Specification Sheets on John Deere Tractors and Equipment

585. Information and specifications on the John Deere crawler and wheel-type industrial tractors and working equipment. Deere & Co., Industrial Division, Moline, Ill. Check the reply card. State type of tractor and equipment.

Basic Fundamentals of High-Speed Earthmoving Techniques

617. This bulletin illustrates and explains the major factors in earthmoving equipment selection. Check the reply card or write the Advertising Division of Caterpillar Tractor Co., Peoria, Ill., for charts and performance characteristics.

Sweeping Brushes for Road and Sanitation Departments

648. Danline brushes made of round brush wire are easily assembled and require a minimum amount of repair and maintenance. Check the reply card or write Newark Brush Co., 260 Michigan Ave., Kenilworth, N. J., for full details.

All-Steel Safety Barricade

709. Highway departments and contractors can use this Guard-Gate in construction and maintenance. Write West Side Iron Works, Inc., 327 Front Ave., N.W., Grand Rapids 4, Mich., or check the reply card for literature on this collapsible barricade.

WEED, DUST & INSECT CONTROL

Heavy-Duty, Non-Volatile Brush and Vegetation Killer

116. Quick acting, complete kill and no drifting Fence Fire kills all brush and weeds with one gallon making up to 100 gallons of spray. Write The Gledhill Road Machinery Co., Galion, Ohio.

How to Cut Weed Control Costs

308. Information on a weed killer that can save hundreds of man-hours of clearing and cutting is available from Diamond Alkali Co., 300 Union Commerce Bldg., Cleveland 14, Ohio. Whether you want to control weeds or brush or both, without damage to crops or ornamentals, get this literature today by checking the reply card.

How to Stop Bothersome Dust

433. A bulletin that covers the use of calcium chloride in the control of dust is available from Wyandotte Chemicals Corp., Michigan Alkali Div., Wyandotte, Mich. Tables on the use of calcium chloride psy are included. Check the reply card.

BUSINESS ADMINISTRATION

Stabilene Film for Drafting, Scribing and Reproduction

60. Stabilene film insures accuracy of drawing and reproduction and will last indefinitely. It comes in rolls, sheets or special sizes to order and lies flat or can be curved or rolled. Check the reply card or write Keuffel & Esser Co., Adams and Third Streets, Hoboken, N. J., for complete catalog.

How Good Are Your Truck Drivers? The Tachograph Will Tell You

682. Accurate records of truck engine operation are made available by the Tachograph. Find out how savings and safety can be promoted by getting Bulletin SU-3 from Wagner Electric Corp., 6400 Plymouth Ave., St. Louis 14, Mo. Details of construction and descriptions of operation are included.

System For Duplicating and Filing Engineering Drawings

754. The Recordak system for comprehensive filing of engineering drawings is described in literature available from Recordak Corp., 415 Madison Ave., New York 17, N.Y. Drawings are first microfilmed and then they are added to an aperture card for indexing.

Ask your Allis-Chalmers dealer to show you ***"And a Great Deal More"***

"This TL-20 Loader Gives Us the REACH We Need at $2,000 to $3,000 Savings on Purchase Price"

"With our crushed stone and lime loading specifications running in excess of 1,000 tons per day," asserted Mr. Walter Van Gorden, treasurer-manager, Cave Stone Company, Cave Indiana, "our requirements on loading equipment are as critical as on any of our manufacturing units. All of the efficiency and production engineered into our excavation and processing equipment is of little value if we cannot maintain like values on the delivery end.

"Because of this, we investigated every available loader on the market before buying our TL-20 TRACTOLOADER* in September, 1957. This decision was made on the basis of actual tests with each piece of equipment which indicated that the TL-20 consistently operated faster, reached farther, lifted higher and gave us more pounds per bucket than anything else in its class. *We would have had to spend $2,000 to $3,000 more for a machine which would equal its production potential.*

"Our two primary requirements for a loader are height and reach. If bucket capacity were our only concern, we could have approached the load of our present unit by simply buying a larger machine of the same make as our previous one. The TL-20 was the only one available in this price class with a two-yard capacity, but, *more important, was the height of the lift and the length of the reach.* With competitive machines, we would have to load the 8 to 14-ton trucks from both sides to get maximum load and balance. The TL-20, on the other hand, has a dumping height of 9 ft with a reach of 34 in. at this height. This increase means that we can easily load from one side without damaging the truck or holding up the driver over 4 minutes.

"Now, with this one machine, we are handling 80% of our loading, and have not yet extended it to its limits. We have yet to become involved with any type of maintenance other than the normal routine upkeep required on any piece of mechanical equipment. In spite of the rugged nature of the application, we expect a minimum of 5 years' service from the unit, and in all probability will replace it with an identical loader."

Let your Allis-Chalmers dealer show you how TRACTOLOADERS can increase your production.

*TRACTOLOADER is a registered Tractomotive trademark.

ALL TRACTOMOTIVE EQUIPMENT IS SOLD AND SERVICED BY YOUR ALLIS-CHALMERS DEALER

TRACTO—
a sure sign
of modern design

TRACTOMOTIVE

TRACTOMOTIVE CORPORATION • DEERFIELD, ILLINOIS

TRACTOLOADERS • TRACTOSHOVELS • TRACTORIPPERS • TRACTOHOES • TRACTOSIDEBOOMS

To order these helpful booklets check the reply card opposite page 38.

STREET LIGHTING AND TRAFFIC CONTROL

Non-Electric Traffic Control Products

156. Reflective pavement marking glasbeads, Cataflex "202" reflective coating, Cataline reflective striping, Catatherm reflective plastic striping, plain and reflective street and highway signs, plain and reflective street name signs are covered in literature from Cataphote, Corp., P. O. Box 2066, Jackson, Miss.

Lighting Standards for Every Outdoor Lighting Requirement

284. Complete design details, typical installation photos and how Hy-Lite standards are made are covered in this valuable guide. Check the reply card or write to the American Concrete Corp., 5092 North Kimberly Ave., Chicago 30, Ill., for Catalog 400.

Use The Reply Card

3M Letters for Large Reflectorized Signs

374. "3M Signal" letters are made with "Scotchlite" reflective sheeting encapsulated in acrylic plastic and are used on large reflectorized signs. Check the reply card or write Minnesota Mining and Mfg. Co., St. Paul 6, Minn., for full details.

Manual on All Types of Traffic Signs

379. This 26-page manual covers regulatory, warning, school, railroad, street name, road construction, route markers, miscellaneous signs and plastic reflectors. Check the reply card or write The Miro-Flex Co., Inc., 1824 East Second St., Wichita 7, Kans., for your copy.

Sign Catalog Has Latest Specifications

417. Detailed information on all classifications of standard signs for traffic control, street identification and other purposes together with a complete line of accessories is presented in a convenient Sign Manual by Lyle Signs, Inc., 2731 University Ave. S. E., Minneapolis 14, Minn. Get Catalog B-55 for most recent data and specifications on U. S. Standard signs.

Handbook on Aluminum Traffic Control Devices

516. Subjects covered in this handbook are sheet signs, extruded signs, sign posts, street signs, and complete specifications for many aluminum uses. A list of Alcoa sales offices is included. Check the handy reply card or write to Aluminum Company of America, Alcoa Building, Pittsburgh 19, Pennsylvania, for mounting, determining size of sign posts and other information today.

REFUSE COLLECTION AND DISPOSAL

Reduce Your Refuse Disposal Costs

150. A complete line of refuse disposal systems that include containers, giant containers, compaction bodies and compaction trailers are described in literature from Dempster Brothers, Dept. PW, Knoxville 17, Tenn. Check the reply card for data on these efficient systems.

Refuse and Garbage Packer Bodies

241. Ranging in capacity from 12 to 24 cu. yds., the M-B packers have a 30 second compaction cycle and have large side loading doors. Write M-B Corp., New Holstein, Wisc., or check the reply card for bulletin on specifications.

New Roto-Pac Features Speed Refuse Collection

50. Features of the Roto-Pac refuse collection unit, which include automatic continuous loading and packing, with increased power to provide for larger loads in the same size body, are described in bulletins issued by City Tank Corp., 53-09 97th Pl., Corona, L. I. Check the reply card now to learn how your collection problems can be eased.

How to Construct A Sanitary Fill

331. A new 12-page booklet which tells the most efficient method of sanitary fill construction and furnishes complete information on planning and operation is now available from Drott Mfg. Corp., Milwaukee 15, Wis. Get your copy by checking the reply card; you'll find this booklet both interesting and valuable.

Data on the Hydro E-Z Pack Disposal Body

572. This disposal body has no moving chains, no whirling knives, and has a 76,600 lb. pressure that takes anything and compacts everything. Check the reply card or write Hydro E-Z Pack, Div. of Hercules Galion Products, Inc., Galion, Ohio, for a copy of Bulletin E-100.

Modern Methods in Sanitary Landfills

699. Up-to-date data, pictures and explanation of sanitary landfill, its methods and equipment are covered in this valuable bulletin from The Oliver Corp., 19300 Euclid Ave., Cleveland 17, O. Check the reply card for information on satisfactory garbage and refuse disposal methods.

Load-Packer With the Big Six Performance by Gar Wood

703. The Load-Packer 600 includes a telescopic hoist that does not require a hoist and sub-frame; simplified controls; and a large 1½ cu. yd. hopper. Catalog from Customer Service Dept., Gar Wood Industries, Inc., Wayne, Mich., or by checking the reply card.

announcing.....RYNAL SR

THE IDEAL STREET BROOM FILAMENT

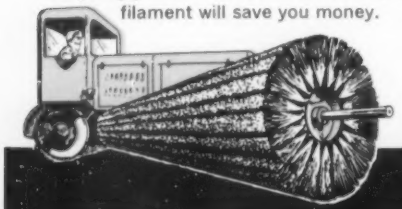
AVAILABLE IN YOUR CHOICE OF THREE PACKAGES

1 **PRE-FABRICATED,** filaments bound in steel for mounting in the RYNAL broom core.

2 **CUSTOM-COILED** on our automatic machinery for a precision product.

3 **BULK** for customer coiling.

Any way you look at it this SR WHITE broom filament will save you money.



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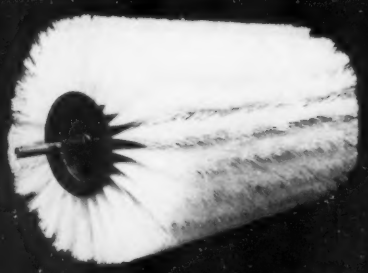
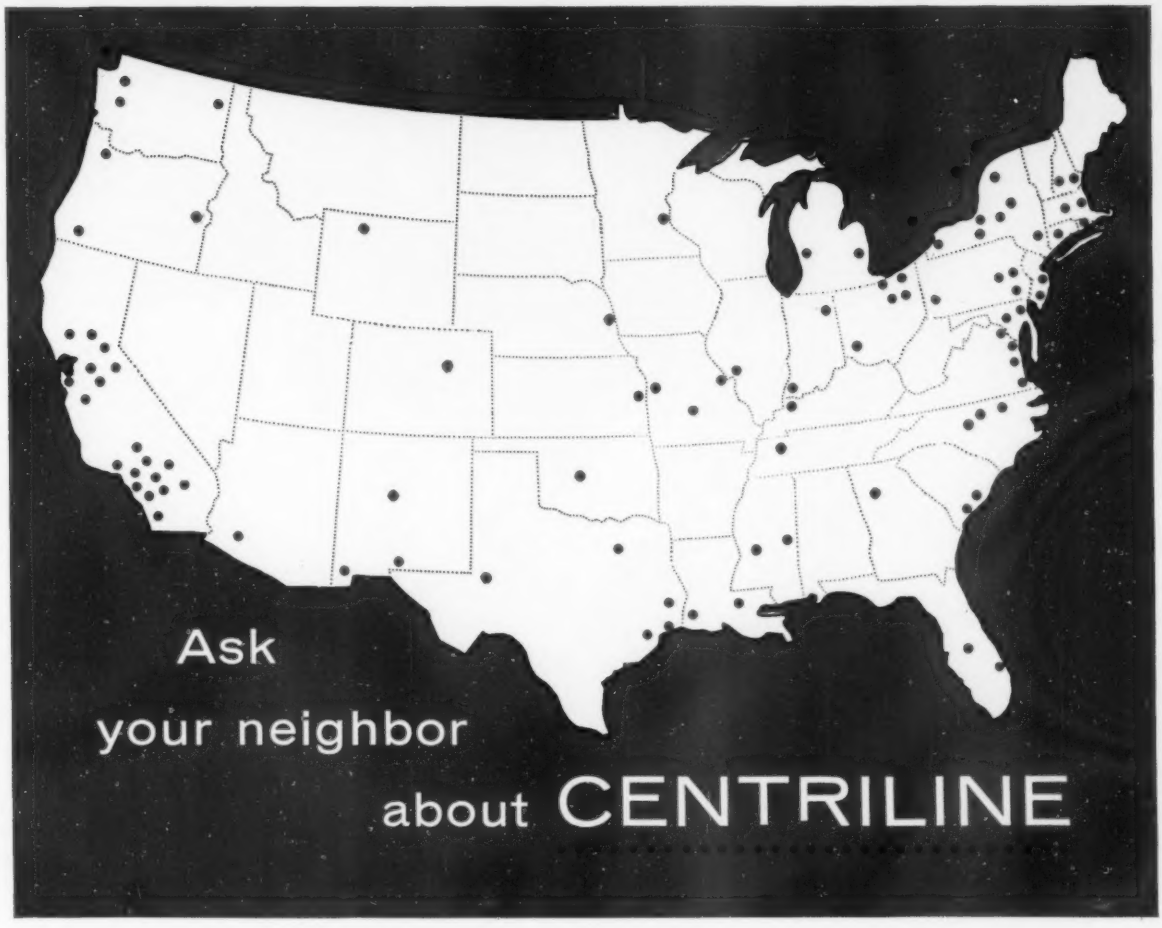
114 ST. JOSEPH STREET
ARCADIA, CALIFORNIA

non-breakable, tough, long-wearing and low priced



MADE IN THE U. S. A.

GIVE US THE MAKE AND MODEL OF YOUR SWEEPERS AND LET US TELL YOU MORE ABOUT IT



Spotted on this map are some of the places that have been served by the Centriline Process

Chances are that one of your colleagues has rejuvenated some of his city's piping by Centriline reconditioning. Here's your chance to find out.

Briefly, this process smoothly lines piping—*in place*—with cement-mortar, creating a pipe-within-a-pipe. This vastly increases carrying capacity, stops leakage, prevents corrosion and tuberculation, and prolongs pipe life indefinitely. Pressure goes up, pumping cost goes down, and there's no need to disturb traffic to replace mains. Over 6,000,000 feet of piping, from 4″ to 144″ diameter, have been treated by Centriline. *Ask your neighbor.*

Write today for a list of nearby officials whose cities have cut inconvenience and costs with this pipe-saving process. Hear what they have to say about Centriline. Then write or call us. We'll be glad to show you how Centriline can help *you* solve the problems of pipe conditioning.

CENTRILINE CORPORATION

A Subsidiary of Raymond International, Inc.

140 CEDAR STREET • NEW YORK 6, N. Y.

Branch offices in principal cities of the United States, Canada, and Latin America.

Can your loader lift its lip and duplicate dozer action? No?

Then trade it off without delay! Because your city will miss cost-cutting opportunities right and left without this *big-capacity* 4-in-1 action. "Radius control" gives positive control of dozing depth; and there's built-in strength for hard digging. This TD-20 4-in-1 is dozing on a heavy grading job.

Can your loader strip, grade, and "boil" itself full on-the-go like a carry-type scraper? No?

Then consider what extra service—and *extra-valuable service* your city could command—with versatile scraper-like action at a 4-in-1 operator's fingertips. This TD-20 4-in-1 is ditching in sticky clay soil —note how easily this action could prepare a trench for storm sewer or culverts!

Only a clam-action 4-in-1 doubles for a whole spread of "big-ticket" rigs

...GIVES INSTANT CHANGEOVERS!

At fingertip lever command, the International Drott 4-in-1 takes over the jobs of several costly machines. You simply move the selector lever from the operator's seat—stopped, or on-the-go—and get your choice of machine actions to do an unlimited variety of operations!

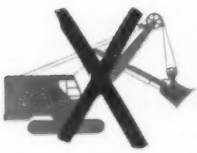
At left, the new 2¼ cu. yd. TD-15 4-in-1 is spreading "cover" uniformly on refuse that it leveled and compacted. Able to double for so many machines, the exclusive clam-action 4-in-1 spreads, levels, compacts, and covers refuse as no other outfit can—to fulfill the requirements of modern minimum-cost sanitary landfill waste disposal!

And beyond that, clam-action 4-in-1 job-range and capacity obsolete old-style, straight-bucket rigs, all over town! City and county officials the country over are proving the exclusive 4-in-1 deserves to be called the "40-in-1" because of the long list of limited-duty machines it can replace!

Compare an International Drott 4-in-1 to your present old-style "single-action" loader—and to excavating, dozing, spreading, and stripping equipment, too! First compare capacity. Then, match 4-in-1 pry-action break-out digging power against the others. Then see how the clam gives dozer, "carry-type scraper," and versatile clamshell action. Prove that exclusive, shock-swallowing Hydro-Spring cuts upkeep; prolongs equipment life. See your International Drott Distributor for a 4-in-1 demonstration!

International Harvester Company, Chicago 1, Illinois
Drott Manufacturing Corp., Milwaukee 15, Wisconsin

INTERNATIONAL® DROTT®



Does your loader have measured, advertised pry-over-shoe breakout action? No?

It's the genuine and exclusive pry-action breakout that enables International Drott 4-in-1's to replace far costlier boom-type rigs, on jobs like breaking up and loading out old curbing and pavement. The TD-9 4-in-1 exerts a huge pry-action breakout force of 18,000 lbs.!

Can your loader "bottom-dump" and handle sticky materials? No?

Then retire the rig and go modern! Your equipment can't be "choosey" about the materials it handles—or be idled by adverse weather that makes materials sticky! But 4-in-1 bottom dumping eliminates the sticky materials problem—and provides a vital dumping height advantage over ordinary roll-forward buckets!

We're Still Looking
for a **Pipe Fitter**
Who Doesn't
Prefer
RIDGID®

"Of Course I said
RIDGID
. . . It's the only pipe wrench for my money. I've got work to do!"

At your Supply House

THREADED PIPE . . . *It's Tight . . . It's Best . . . Costs Less!*

Commentary
on Water and Sewage Treatment

"NO SWIMMING— PUBLIC WATER SUPPLY"

R. S. RANKIN
Consultant, Water and Sewage Treatment

A VERY POSITIVE order this but nevertheless one which is constantly being challenged by sports-minded young and old and just as persistently being enforced by authorities watching over the supply of water used for drinking. Sometimes, though, one wonders how long this form of prohibition can endure or whether there is some other solution more satisfying to everyone. A month ago this same subject was commented on in this column but, in view of an incident recently related in a New York newspaper, it seems worth taking a second look at it.

The incident referred to involved a certain pond, one in a chain which eventually discharges into a reservoir serving Waterbury, Conn., a city of over 100,000, thirty-five miles downstream from the pond. According to the newspaper account this particular pond for twenty-seven years had served as a place to swim for guests at a modest summer resort. No one had ever complained about it or ever heard of any restrictions. The Boy Scouts of a nearby Council, however, recently entered negotiations to buy the place and erect a camp with the obvious intent of enjoying all the same benefits although possibly on a somewhat larger scale. The scheme came to the attention of the State Board of Health which promptly disapproved it and said no swimming would be allowed in the pond. The reason given was that the water supply of Waterbury would be endangered and, if allowed, the city would be forced to construct a filtration plant. The Boy Scouts apparently have dropped the project.

This incident is illuminating as it shows to what limits cities in populous areas must resort in order to maintain their raw water supply fit for human consumption without any treatment except disinfection. It seems somewhat incredible to believe that the health of the inhabitants of a city of over 100,000 could be put in jeopardy by some boys swimming in a pond thirty-five miles way. Incidentally, the outlet of this pond and the next one downstream discharge into an open watercourse so, to be safe, preventive measures must also apply to these sections.

This denial of what was once the inalienable right of every boy, namely to swim wherever there was water, has created serious problems of enforcement.

new heavy duty MUELLER®

CHECK VALVES

Specifically designed for repeated opening and closing applications.

■ These new, heavy duty Water Works Check Valves have been specifically designed to reduce wear caused by repeated opening and closing when used in such installations as pump suction or discharge lines. ■ All working parts are heavily constructed from high-strength materials to assure long, dependable operation without maintenance. A new combined hinge pin and plug is held to the body by studs and nuts. An "O" ring positively seals the plug to prevent leakage. Large, wear-resistant bearings assure alignment and rigidity of the gate to reduce chatter and vibration. A heavy stainless steel hinge pin is used on all lever and weight type and lever and spring type check valves. ■ The many exclusive features of these new, heavy duty check valves are typical of the attention to detail in research, design and engineering that becomes a part of every Mueller product made for the water industry.

Write today for complete information and specifications.

MUELLER CO.
DECATUR, ILL.

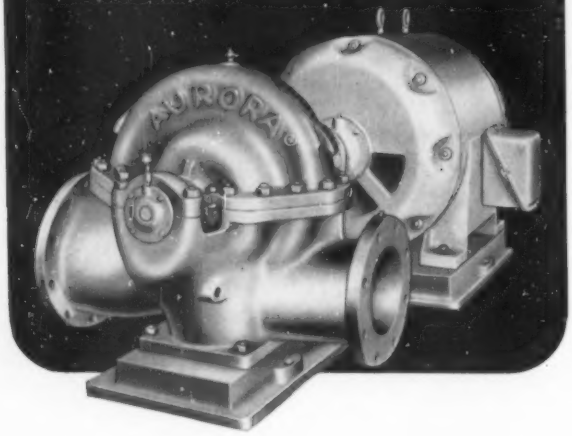
Factories at: Decatur, Chattanooga, Los Angeles;
In Canada: Mueller, Limited, Sarnia, Ontario

ideal for use in:

PUMPING STATIONS
SEWAGE TREATMENT PLANTS
FILTRATION PLANTS
INDUSTRIAL PLANTS

Iron Body — Bronze Mounted
Flanged, Screwed or Hub Ends
Working Pressure: 175 p.s.i.
Sizes: 4", 6" and 8"

FAST, EASY MAINTENANCE

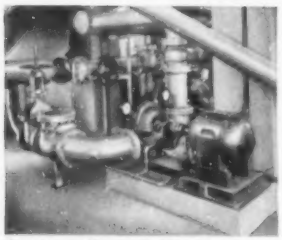


Just one more important reason these

AURORA® *HORIZONTAL SPLIT CASE, DOUBLE SUCTION*

CENTRIFUGAL PUMPS

give greater service



Two Aurora Type "O" Centrifugal Pumps, driven by 15HP, 1150 RPM motors are serving as cooling tower pumps in the plant of C. Schmidt & Sons, Inc., Brewers, Philadelphia, Pennsylvania.

Two Aurora Type "O" Condensation Water Pumps are installed in the Hillsborough County Courthouse, Tampa, Florida. Duty, 1400 GPM against 50' TDH at 1750 RPM.

Whether municipality or industry, you want a pump built for long, maintenance-free life. Equally important, when maintenance *is* needed, you want lines back in service fast!

These Aurora Type OJ centrifugal pumps are built for rugged service, and can be quickly maintained without disturbing suction or discharge piping or pump-motor-base alignment.

They are ideal for municipal or industrial water service for line pressure build-up, boosting to pressure tanks or elevated tanks, cooling tower service, fuel transfer, fire pumps, marine service, circulating, boiler feed service and many other general applications.

For complete range and engineering information, write for Bulletin 105-B

AURORA Always PUMPS

AURORA PUMP DIVISION
THE NEW YORK AIR BRAKE COMPANY
630 LOUCKS STREET AURORA • ILLINOIS

Every year brings demands to open up reservoirs and streams for sports and each year an opposing battle is fought all over again. How much simpler matters would be if these objections could be removed and instead regulated recreational facilities were provided. It is of interest to estimate what would be required to protect the city of Waterbury from the contamination created by the proposed camp. But before going into this, the question might be raised as to whether Waterbury is unique in being faced with this problem.

Surface Supplies and Treatment

One way to answer this is to compare practice in other similar U. S. cities over 100,000 in 1950. In 1952, a survey of this population group brought out some interesting facts (1).

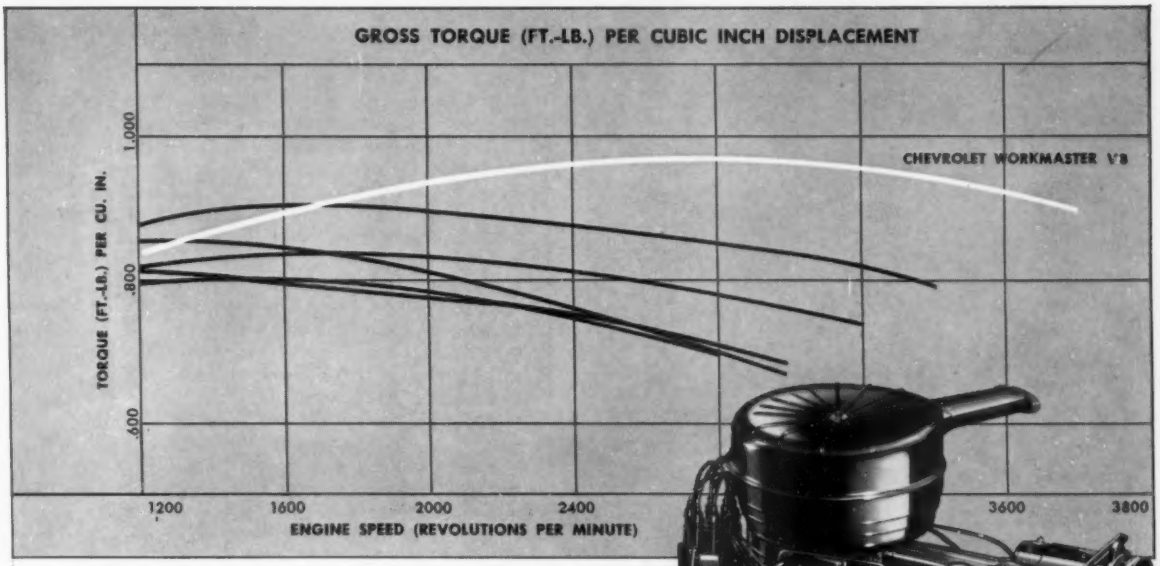
Number of cities over 100,000 using surface supplies	
On the Great Lakes	11
On streams and rivers	70
Total	81
Of these the number with filtered surface supplies	
On the Great Lakes	10
On streams and rivers	47
Total	57 or 70%
and the number using unfiltered surface supplies	
In northeastern U.S.	17
In other areas	7
Total	24 or 30%

Of those seven cities in other areas using unfiltered surface supplies, one is Duluth which takes its supply from the frigid Lake Superior and the other six take their supplies from western mountain streams remote from industry or habitation. The seventeen cities in northeastern United States include New York City and Boston. It is these two groups using unfiltered supplies that are the most resistant to any move to let down the bars on recreational facilities and, of course, they must continue to resist as long as their supplies are unfiltered. However, it seems that a heavy burden of responsibility is placed on the sanitary engineering staffs of the water suppliers and the state boards of health to keep these sources free of contamination, both real and potential. Even with their combined efforts a high quality water every day in the year is not assured.

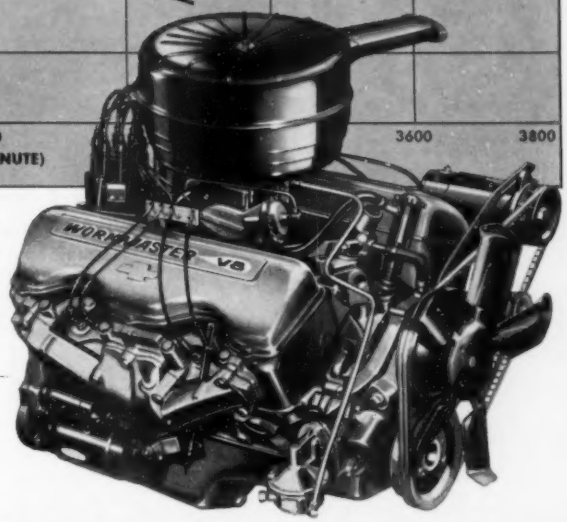
What is true of these cities over 100,000 also must be true of cities less than 100,000. As a matter of fact, a previously mentioned survey showed 37% of the population in all cities over 25,000 are supplied with unfiltered surface water. Hence an even larger percentage of cities under 100,000 must be using unfiltered supplies.

One sure way to obtain relief from the burden of constant inspection and the annual clamor from sportsmen is to do what other cities which have little or no practical control over their supplies have done and that is to provide filtration plants. This will accomplish far more than merely remove the necessity for strict supervision of the source. It will provide a water free from taste, odor, color or turbidity; a quality water in other words, the year around. Filtration will also provide a water more attractive to industry. Many industries doing the precision work of today cannot afford to tolerate any impurities in their water supply. For an industry to be required to provide its own water treatment works at one location can often be a

It's torque that beats tough jobs, and this engine has it to spare!



Proof that the Workmaster V8 puts out plenty of torque. The white curve above shows that the Workmaster provides high torque throughout the *entire range* of operating speeds. The black curves accurately represent the torque output of typical heavy-duty 6-cylinder engines of between 330 and 390 cubic inches of displacement. Curves demonstrate actual torque efficiency, based on gross ft.-lbs. of torque per cubic inch of displacement.



CHEVROLET'S 348-CUBIC-INCH WORKMASTER V8

It's torque that gives a truck plow-horse pulling ability at low speeds and assures the power to keep big loads moving, whether it's through the rough or over the road. And Chevrolet's 230-h.p. Workmaster V8 puts out a brand of torque that's made to order for your toughest big-tonnage hauls.

High torque output is the natural result of the Workmaster V8's unique design characteristics. Short piston stroke and large piston area, for example, comprise a torque-producing advantage, and *this engine provides the shortest stroke in its class.*

Advanced Wedge-Head design, with its fully machined combustion chambers, means high torque, too. It assures high turbulence of the fuel-air mixture and balanced power output from each cylinder. The Workmaster V8 has high volumetric efficiency . . . takes in the fuel-air mixture *efficiently* at all speeds. This, combined with a camshaft design that gives just the right valve lift and timing, assures high torque—extra pulling power to get you through the tough spots!

For the kind of torque and toughness you need to do big jobs better, see your Chevrolet dealer about a Workmaster V8, now standard in Series 90 and 100 trucks. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

No job's too tough for a Chevrolet Truck!

CHEVROLET

ELIMINATE YOUR
WATER TREATMENT
PROBLEMS
WITH

Ferri-Floc
FERRIC SULFATE

Ferri-Floc
FERRIC SULFATE

FERRI-FLOC produces rapid Floc Formation — Controls Taste and Odors — Coagulates Over Wide pH Range — Increases Filter Runs — Removes Turbidity, Color, Manganese, Silical and Bacteria . . . Ferri-Floc is a free flowing granular salt that can be fed through most standard dry feed equipment . . . Ferri-Floc is easy to handle and will keep for long periods of time in closed hoppers.

WATER TREATMENT
Efficient Coagulation of Surface or Well Water—Effective in lime soda-ash softening — Adaptable in treatment of all industrial applications.

SEWAGE TREATMENT
Coagulates over wide pH ranges and provides efficient operation regardless of rapid variations of raw sewage — Very effective for conditioning sludge prior to vacuum filtration or drying on beds.

COPPER SULFATE safely controls about 90% of microorganism normally encountered in water treatment plants efficiently and more economically than any other chemical.

COPPER SULFATE

SULFUR DIOXIDE is used most effectively for dechlorination in water treatment and to remove objectionable odors remaining after purification.

SULFUR DIOXIDE
HIGHEST QUALITY
SO_2

FREE BOOKLET
Let us send you without charge, a 38-page booklet that deals specifically with all phases of coagulation—just send us a postal card.

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reason for selecting another location where it does not have to employ a year around staff for this unrelated function.

Suppose, for example, the City of Waterbury does what the State says will be necessary if swimming in these ponds is permitted, namely build a water filtration plant. Would it "cost several million dollars and be expensive to operate?" One thing is certain, if it did filter the supply, the city would join the majority group of cities which have found sufficient funds to build and operate such plants.

Assuming for discussion that a plant with a capacity of 15 mgd is required. It could probably be built for from $100,000 to $125,000 per million gallons or a total of say $2,000,000. If it is financed over a 25-year period, this sum would require an annual contribution of from $1.50 to $2.00 per capita. To operate this plant, the cost would probably run from 7 to 10 cents per 1000 gal. or less than a penny a day per capita. The city already has its distribution system which is far and away the most costly element in any water works so that any necessary increase in rates would be due only to the cost of the filtration plant. However, if Waterbury is like many other cities, water rates are too low but some incentive is needed to justify any increase. A filtration plant would surely provide adequate justification. The increase in rates would assure the citizens of having a quality water for domestic purposes at all times and industry would have a supply free of aggravating impurities.

It seems odd that the areas of greatest population concentration should be forced to rely solely on watershed and reservoir patrol backed by enforcement of strict laws to assure a safe water supply and even then not be certain of year around quality. How much better off they would be to follow the pattern of other areas less able to control their supplies where filtration is really necessary. Hopkins (2) states that it is apparent the modern trend is to rely more and more on the efficient operation of the treatment plant rather than to develop an elaborate inspection system for the watershed of impounding reservoirs. If the state health authorities were relieved of this constant and necessary surveillance, they could devote more time to overcoming major pollution, the real problem in these areas. Supervised recreation even including swimming will be possible without making the headlines in the New York papers. Water treatment has been the answer in other places, why not in Waterbury?

References

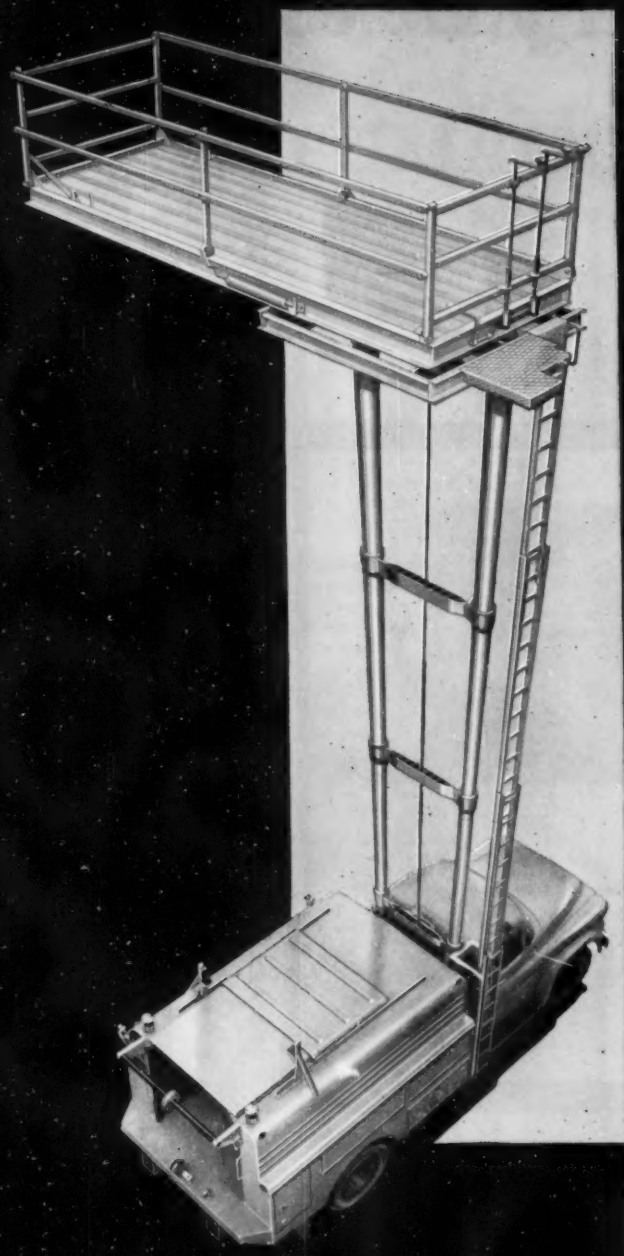
(1) Kenneth W. Cosens, Design and Operation Data on Rapid Sand Filtration Plants in the U.S. and Canada. Jrnl. AWWA 1956, Pg. 819

(2) Edward S. Hopkins, Views on Watershed Control—A Symposium. Jrnl. AWWA 1954, Pg. 403.

• • •

Painting Roadway Edges

An innovation in the pavement-marking program during 1958 was the painting of roadway edges over selected sections of Wayne County roads in Michigan. Approximately 95 miles of these edge lines, four-inches wide in reflectorized white paint, were applied on various roads. Many favorable comments have been received on the effectiveness of the edge markings, and "Before" and "After" accident studies are being made to determine their value as a safety measure.



WORKSHOP WITH A 35 FT. REACH

POWERS-AMERICAN

HYDRAULIC AERIAL TOWER

There's 44 sq. ft. of work space on the insulated platform of the Powers-American Series TW-2 Hydraulic Aerial Tower. Plenty of elbowroom for the overhead crew plus tools and materials.

Two perfectly-synchronized powerful hydraulic cylinders do the lifting work . . . elevate the platform to any height, up to its maximum reach which enables the crew to work 35 ft. above ground. Dual controls permit operation of the tower from the platform or the truck cab. Platform can be rotated continuously in either direction . . . enabling the crew to reach work in an area of 250 sq. ft.—without moving the truck.

The work-speeding, cost-cutting advantages of the TW-2 Tower can be combined with a Powers-American Body that's just right for your particular operation.

Descriptive literature and price information is yours for the asking.

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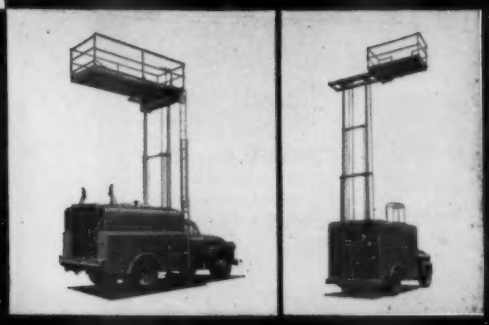
POWERS American

UTILITY BODIES AND EQUIPMENT



Series 7A-01 Tower (at left) is available in 21' and 25' models. Powers-American Towers can also be furnished with lateral-extending platform (at right), with stationary platform, or with special platform and operating features to meet your specific job needs.

Build your corrosion-

Bitumastic Super-Service Black—excellent heavy-bodied protection for structurals, tanks, equipment, and concrete, too.

Bitumastic No. 50—the thickest protective coating you can buy—and thickness spells long-life in tough service!

Bitumastic Hi-Heat Gray—all the name implies: a special zinc-base coating for stacks, boilers, other hot spots.

Bitumastic Black Solution—a paint-like general maintenance coating *but* with coal tar's unique protective ability.

Bituplastic No. 28—almost equal in body to No. 50, and an excellent weather-resistant coating.

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prevention program around

BITUMASTIC COATINGS

Experienced Service
—almost as important as our fine product, you'll get it from our specialists on corrosion.

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—used alone, or as a decorative top-coat for Bituplastic No. 28, this coating has amazing gloss-retention.

As with most engineering problems, there's no one, pat answer to all corrosive conditions: that's why Koppers designed the *line* of coatings under the Bitumastic® label. Covering a broad range of cost and protective ability, it is likely that the *one* best solution to your corrosion problem can be found among the coatings in the Bitumastic line.

The common denominator to the protective ability of Bitumastic coatings is coal tar: nature's own "wonder material" that has unique resistance to oxidation and water penetration, common causes of coating system failures. The magical properties of coal tar make a story in themselves, however, and we'll be glad to send you a booklet that describes them more fully.

In fact, if you're not familiar with Bitumastic protective coatings, we'll be glad to send any or all of the literature noted below. Or perhaps you'd like to review your problem with a Koppers representative or an experienced Bitumastic distributor. Just indicate your choice on the coupon below. No obligation, of course.

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Progressive communities* are including bituminized fibre pipe in their codes . . . BERMICO is lightweight, rootproof, easy-to-install . . . lasting protection for sewer lines or house-to-septic tank connections . . . exceeds Federal Specification SS-P-356 . . .

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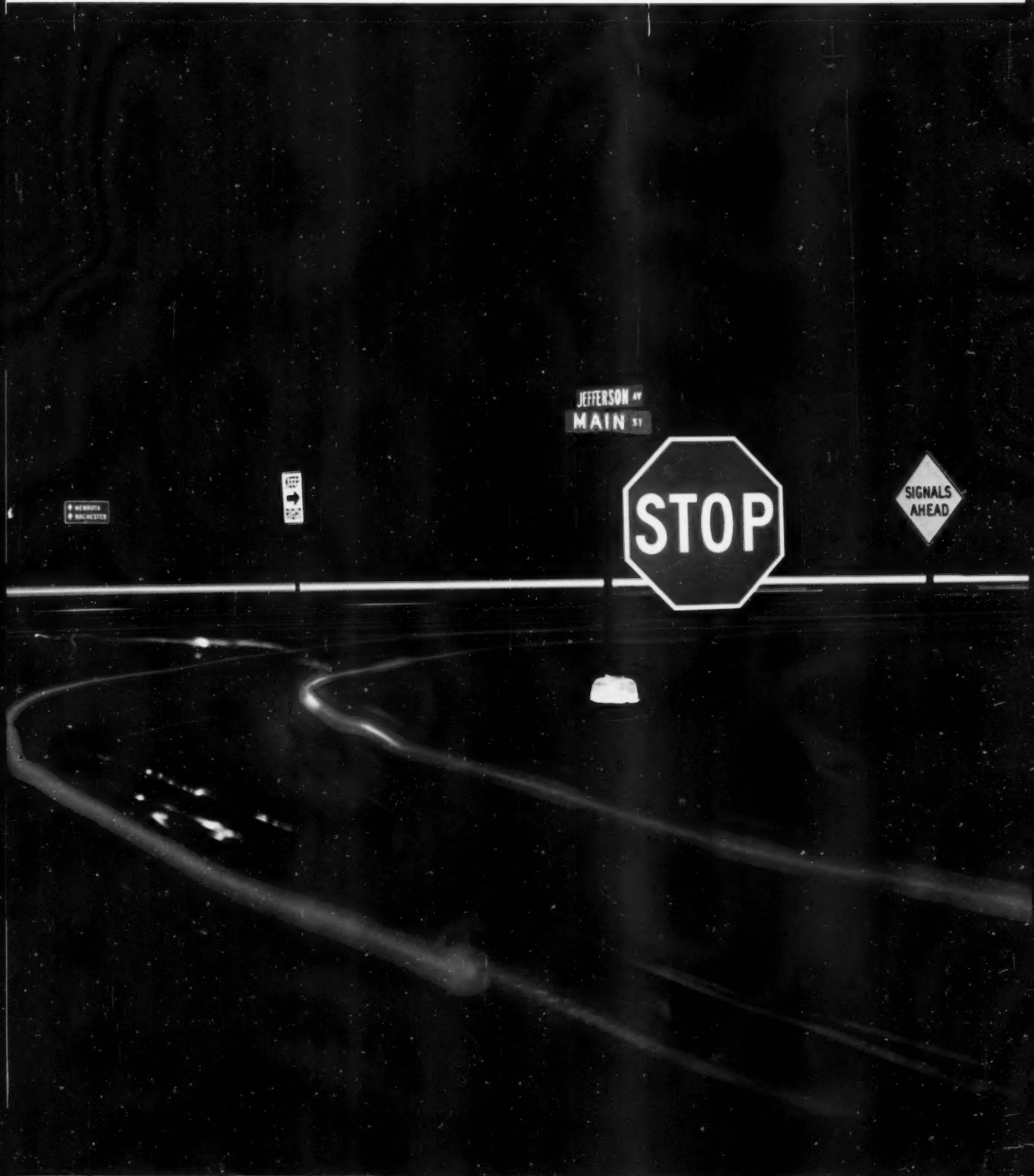
Where Modern Traffic Control and Safety Begin

. . with reflective color that works night and day



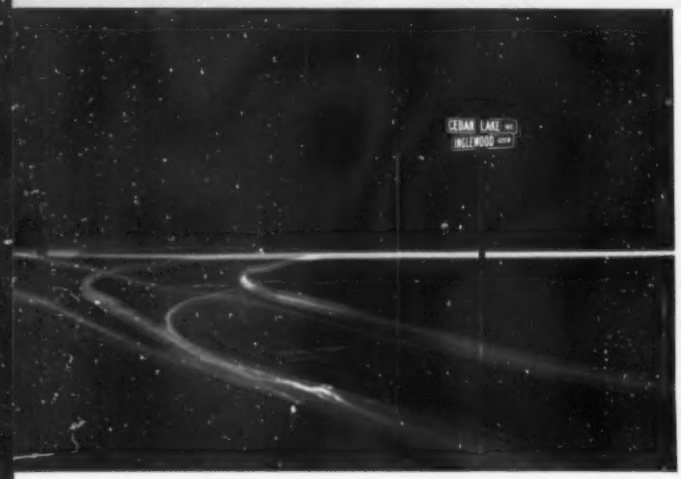
How to improve traffic flow; make hours, in all weather, on all roads, How reflective color can work for

You get vital visibility with signs of "SCOTCHLITE" REFLECTIVE SHEETING

They warn, regulate and guide with the same distinctive shape, vivid color and clear legend, 24 hours a day. Such signs are instantly seen and understood because they employ a logical 4-color system.

You get all-weather performance with signs of "SCOTCHLITE" REFLECTIVE SHEETING

Even when completely wet they won't "black out." A clear plastic shield seals out moisture, protects reflective elements from distortion. The heaviest rain can't appreciably affect brightness.



Street name signs of "SCOTCHLITE" REFLECTIVE SHEETING **leap to life at night**

Drivers see where they are at a glance, and in time to signal and turn. No more slowing of traffic, dangerous, sudden stops or quick turns. Street names will be brightly, conveniently visible 24 hours a day.

Road hazards painted with "CODIT" LIQUID **are white by day, bright by night**

Sprays or brushes on smooth or porous surfaces. Provides wide-angle reflectivity. Covers at less than 17¢ per sq. ft. Shows driver length and angle of curves; marks bridges, viaducts, and similar hazards.

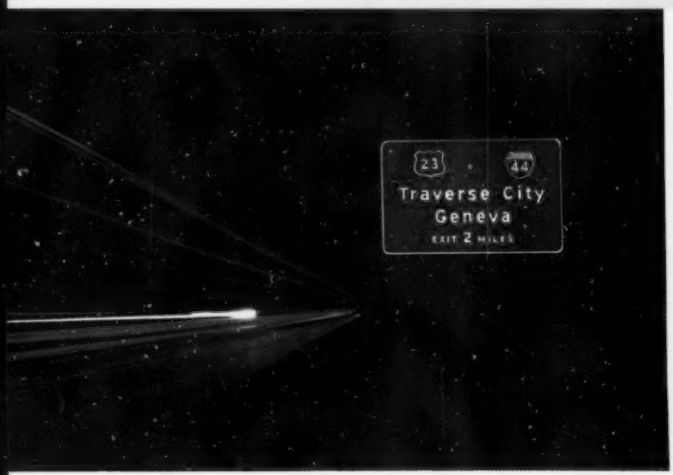
driving safer, easier at all highways and streets. you:

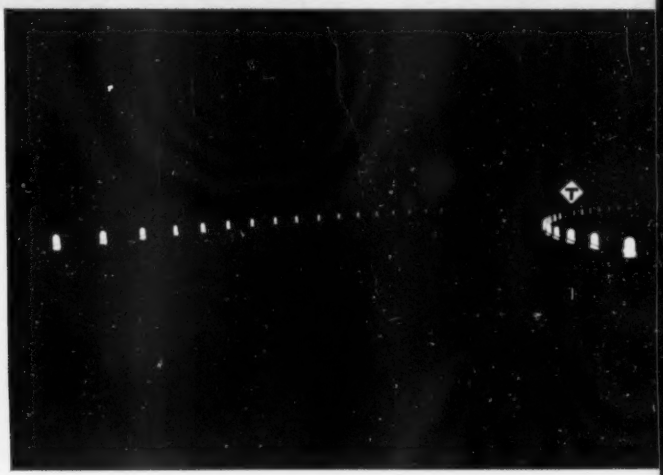
You get wide-angle reflection with signs of "SCOTCHLITE"
REFLECTIVE SHEETING

Always brightly visible from practically all angles of approach . . . you can locate each sign for most effective traffic control. All signs will continue to communicate even when bent or twisted.

You get greater economy with signs of "SCOTCHLITE"
REFLECTIVE SHEETING

They offer a long useful life and require minimum maintenance. Sign faces are completely smooth and flat so they resist effects of weather and dirt accumulation. Dust washes away in rain.





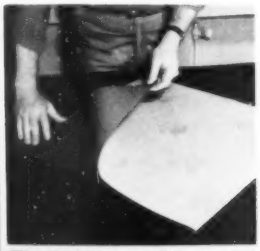
Completely reflectorized guide signs speed highway traffic at all hours

Bright "3M Signal" Letters provide complete, continuous legibility night and day. Against brilliant backgrounds of green "Scotchlite" Sheeting they offer the utmost in visibility and clarity.

Wide-angle delineators define and safely highlight the road ahead

There's a type for every delineation job—"wrap-around", "rigid" or "3M Signal" units that employ "Scotchlite" Sheeting, and "Codit" Reflective Liquid offer flexible, effective delineation at low cost.

You can make perfect, durable, reflectorized signs in your own shop in minutes at low, low cost



It's as simple as this. First, remove paper backing from ready-to-mount face of "Scotchlite" Reflective Sheeting. Anyone can do it easily.

Next, position prepared sign face on blank. You can use existing signs or new metal. Sign faces meet all BPR standards.

Your own automatic vacuum applicator is the key to fast, economical production (and they're available in a variety of sizes to meet all needs). When faces and blanks have been prepared as indicated in small photos, simply place in applicator and start. In minutes you'll have new reflectorized signs. The cost? As little as $3.60 each when you use your old sign blanks. And you can use your applicator to make street name signs, markers and other safety and guidance devices.

And the signs you make will last and last. Individual materials, finished faces, complete signs, all have been subjected to every type of laboratory and field test. The "weather tester" at right, for example, duplicates all of the conditions under which a traffic sign may have to function. Your signs will be brightly, colorfully visible at all hours, in all weather for years. Why not write today for complete information?

Constant testing, continuous research is carried on in the 3M Company's new Graphic Products Laboratory. From such research has come these products to make highways, roads and streets safer: "Scotchlite" Reflective Sheeting, "Codit" Reflective Liquid, "Centerlite" Reflective Compound and "3M Signal" Letters and Delineators.

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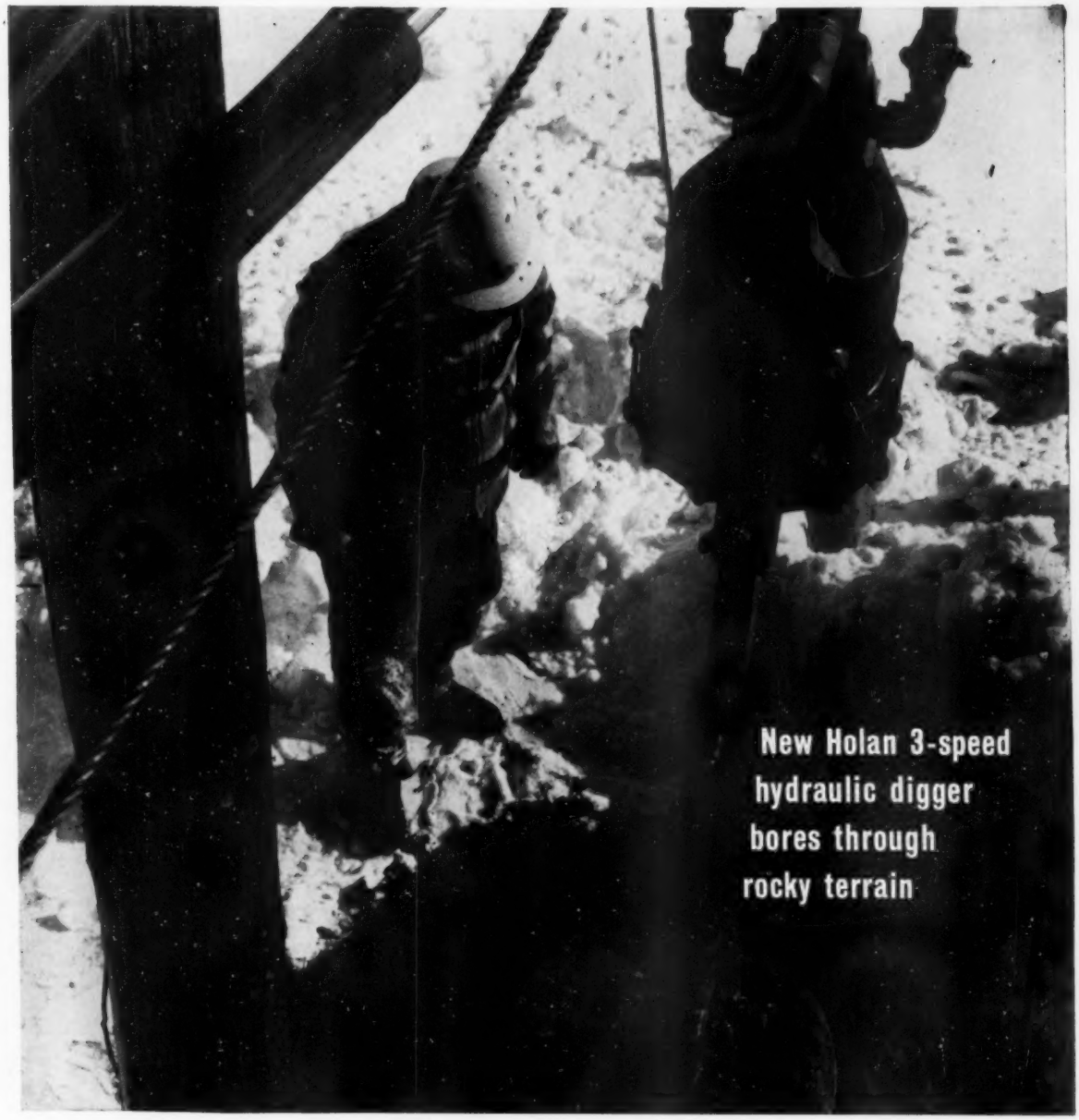

Torque: 8,400 ft.-lbs.

There's a new kind of hydraulic digger in the field—a digger with greater auger torque than any other derrick-suspended borer in use today.

The Holan 3-speed Series 5400 Digger handles augers up to 30 inches in diameter, and provides 8,400 ft.-lbs. torque. In addition to the high torque speed for big augers and tough digging, there's a faster speed for normal digging and augers 16 inches or less. A third speed is for spinning dirt and mud off the auger blades.

A positioning cylinder assures straight holes, aligns the auger for digging anchor holes and provides more clearance while setting poles. The swivel-mounted digger swings any way the operator desires. One man controls the unit from the rear of the truck.

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California's Aluminum Construction Signs Can Take It!

Highway construction signs get a lot of punishment. That's why these new signs are fabricated of Alcoa® Aluminum. Despite jostling around on trucks, rough handling, hasty erection, weather—these rugged Alcoa signs can double and even triple message life. Aluminum's inherent corrosion resistance eliminates progressive deterioration and delamination, even if the surface should be pierced by flying stones or damaged by vandals. Lighter weight makes them easier to transport from one job site to another. These new Alcoa signs are available in any size and can be painted or faced with "Scotchlite"* reflective sheeting. Messages can be changed at will. For immediate details on how their long life saves you money, write direct to: Aluminum Company of America, 1709-F Alcoa Building, Pittsburgh 19, Pennsylvania.

*Trademark of Minnesota Mining and Mfg. Co.

Easy to see at all times . . . simple to erect . . . no maintenance ever required . . . that's why the California State Highways Department installs these new signs of Alcoa Aluminum *exclusively* wherever highway construction is in progress.

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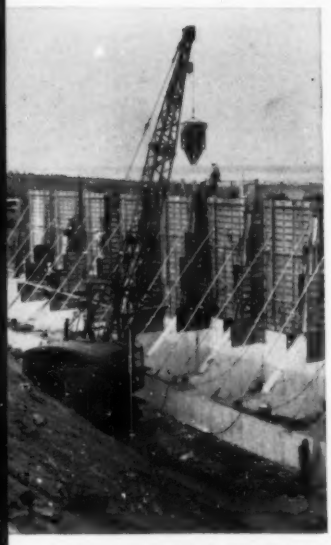
CONCRETE PERFORMANCE REPORT:

Pozzolith employed to meet full range of engineering requirements for all types of concrete specified

This job involved some 800,000 cubic yards of concrete. The Air Force Academy Construction Agency and the architects—Skidmore, Owings and Merrill—jointly supervised all construction and established an on-site concrete materials control laboratory. During July and August, 1956—with only a few thousand yards of concrete placed—they observed erratic and low compressive concrete strengths. The wide range and rapid changes in temperature were suspected as the cause.

AERIAL VIEW of nearly completed Air Force Academy. Construction under supervision of the Air Force Academy Construction Agency. Architects: Skidmore, Owings & Merrill, Chicago • Over 24 contractors were engaged in major concrete work. Ready-mixed concrete was supplied from central batch plants operated by: Concrete Materials, Inc., Kansas City • General Concrete Co., Colorado Springs • Transit Mix Concrete Co., Colorado Springs.

AIR FORCE ACADEMY



CONCRETE RETAINING WALLS reach 36 feet high over much of the 10,000 foot length. Walls required a placeable mix of 2" to 4" slump with design strength of 3,000 psi.

COMPREHENSIVE TESTS were made and established that Pozzolith would provide uniform, high strength throughout the wide range of temperature changes experienced between early morning concreting at about 50°F and mid-day concreting at 75° to 80°F. In September 1956, Pozzolith was first employed in concrete at the Academy. The successful performance here led engineers to investigate the use of Pozzolith for control of other classes of concrete — including lightweight aggregate concrete, prestressed concrete and structural concrete. *As a result of this investigation, Pozzolith and only Pozzolith was used as the water-reducing, set-controlling admixture for the project.*

Pozzolith was used in over 750,000 of the 800,000 cubic yards of concrete at the Air Force Academy. For each of the many classes and types of concrete specified—it provided the required batch-to-batch uniformity, most economically, for the broad range of job requirements and varied climatic conditions encountered at the site.

The Master Builders field men worked closely with project engineers, the field control laboratory, contractors, and concrete suppliers at the Air Force Academy to achieve the common goal of uniform, superior quality concrete at lowest cost-in-place.

Write for your free copy of the *detailed* "Air Force Academy Concrete Performance Report".

PRESTRESSED CONCRETE BRIDGE GIRDERS required compressive strengths of 4,500 psi before application of stress. The Pozzolith mix provided initial retardation for good consolidation in the form, yet accelerated early strength, producing 6,500 psi in 7 days.

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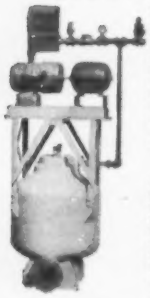
*Pozzolith is a registered trademark of The Master Builders Co. for its concrete admixture to reduce water and control entrainment of air and rate of hardening.

You get what you pay for, every time . . . and it PAYS to invest in the experienced engineering, expert workmanship and dependable operation of

BLACKBURN-SMITH
Pneumatic
SEWAGE EJECTORS



Satisfied users of Blackburn-Smith Ejectors everywhere are convinced they've made the best investment in "B-S" efficient, economical, uninterrupted sewage lift service. No pump troubles; no clogging or cleaning; no complex piping; lowest maintenance cost. Single, duplex units. 30 to 500 g.p.m. Discharge heads to 150 ft. The dependably engineered product of 60 years of experience.

SEND FOR LATEST BOOKLET

Booklet S-55 gives piping diagrams for electrode and float switch controls; dimensions and layouts for single and duplex systems; all needed installation and operating data. Write for your copy today.

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Municipal Power

ANALYSIS OF ELECTRIC SYSTEM OPERATIONS

BRUCE J. ENNIS
Principal Engineer,
Burns & McDonnell Engineering Co.,
Kansas City, Missouri

A PROBLEM constantly confronting the management of an electric utility concerns the determination of the degree to which it has been successful in the operation and maintenance of the physical properties and in the management of the financial and economic business of the system. To gain proper perspective of the individual utility's condition, it is desirable, and often helpful, to compare its operations with those of a group of other utilities of similar type and scope. By so doing, it is possible to evaluate the adherence to, or departure from, an average set of annual operating ratios and relationships which provide a "normal" datum for comparison. Through such comparisons, it is possible to draw conclusions and answer questions regarding the given utility such as:

1) Are the rates charged for electric service too high, or inequitable among the various classes of consumers?

2) Are the rates too low to provide sufficient revenue for the cost of efficient operation and maintenance of the properties?

3) Are the system designs and the accuracy and thoroughness of electric metering adequate to restrict system losses and unaccounted-for energy losses to an acceptable value?

4) Are the operating and maintenance expenses too high in proportion to electric operating revenue?

5) Is a sufficient amount being set aside each year for the depreciation of the physical properties of the system?

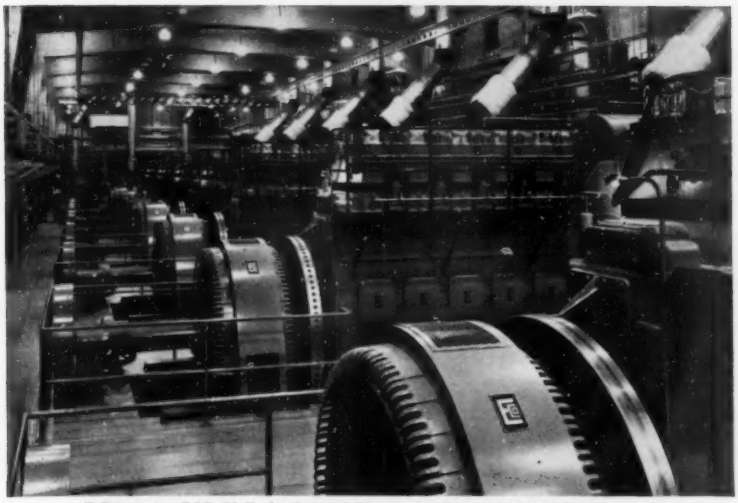
6) Is the amount of insurance coverage carried by the utility sufficient to provide normal financial protection against the hazards of fire, boiler and machinery explosion and breakdown, and other losses which might jeopardize system operations?

The operation of an utility is, to a considerable extent, dependent on its geographical location. Such items as fuel costs, labor rates, etc. directly affect possible economies of system operations, and the design of and investment in transmission lines and distribution facilities is influenced by expected severity of weather conditions and the density and type of load in the service area. General business conditions, the amount of energy consumed by the residential, commercial and industrial customers, prevailing climatic conditions (on which depend the extent of summertime air conditioning load or wintertime home heating energy consumption), and other related factors, all have a bearing on system operations.

With such a variety of conditions affecting system operations, it is difficult to compare two given utilities except in a rather general sense. It is however, possible to point out areas to similarity or dis-similarity of a given utility's operations with nation-wide averages and with the average of groups of other utilities of similar type and scope, so as to draw conclusions as to the operation, maintenance and financial conditions of the individual utility systems. Such comparisons may be drawn based on data contained in the "Statistics of Electric Utilities in the United States—1957" as published by the Federal Power Commission for: (a) Class A and B Publicly Owned Systems; and (b) Class A and B Privately Owned Companies. These two publications contain respectively a wealth of operating data and statistics for 320 publicly owned and 263 privately owned electric systems in the United States for the year ended December 31, 1957, which are the latest published data available. The publications are for sale by the United States Government Printing Office, Washington 25, D. C.

Using the compiled Federal Power Commission Statistics, innumerable operating ratios and statistical relationships may be computed to serve as standards of comparison. Equivalent ratios may be derived from the data of a utility system for which

Behind Our Air Power And The SAGE System



7 Enterprise DSQ-38 Turbocharged Diesels provide completely independent power at "joint center" SAGE system power plant, McChord AFB, Wash.

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This is one of the vital SAGE* system plants powered by Enterprise. In all, 25 Enterprise Engines provide some 44,000 HP, or 31,000 KW of power required to operate four of the complex SAGE network centers.

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comparative operational analyses are desired. The nature and scope of the operating ratios to be used in system comparisons will depend on the particular results desired, and may be formulated for the individual system to the extent that statistical data are available. In general, however, the analysis of a given utility's operations, in comparison with those of a group of similar utilities used as a "standard", might include operating ratios and relationships similar to the following examples:

1) Electric Utility Plant Investment per Dollar of Gross Operating Revenues: This ratio indicates the extent to which the physical properties of the system are being utilized to produce the revenue required to operate and maintain the system. Too high a ratio for a given utility, in comparison with the average "standard", would indicate either an abnormal amount of investment in plant properties, or insufficient revenues resultant from: 1. Too low a rate for electric service; or 2. subnormal consumption of energy by the given utility's consumers.

2) Electric Operating Expenses to Gross Operating Revenues: If a given utility's ratio for this item is higher than the average ratio for the group of utilities used as a standard of comparison, the indications are that the given utility's cost of operating and maintaining its system is excessive, or that insufficient revenue is being obtained because of substandard electric service rates or consumer utilization. Conversely, a lower-than-average ratio for this item would indicate sound management of the given utility's business and efficient operation of its properties.

3) Depreciation Reserve Appropriation to Net Utility Plant Investment: Comparison of the given utility's ratio for this item with the average ratio of the standard utility group will determine whether or not adequate funds are being set aside to compensate for wear and tear on utility plant equipment and facilities, in keeping with the business management policies of the standard group.

The Federal Power Commission statistics contain data from which it is a simple matter to compute a great variety of other ratios with which to analyze a given utility's management, operating, and maintenance policies in comparison with those of a consolidated group of other utilities. Additional ratios and relationships might be compared and analyzed, as follows:

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For locations under water pressure and nominal movement.

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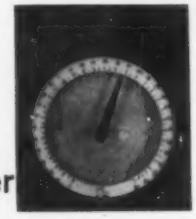

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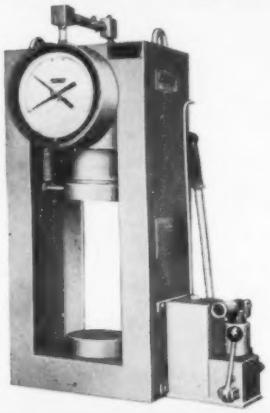

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4) Insurance Expense to Net Utility Plant Investment.

5) Maintenance Expense to Net Utility Plant Investment.

6) System Losses and unaccounted for KWH to total KWH Generated and Purchased.

7) Average Annual KWH sales per Consumer: a. Residential; b. Commercial and Industrial; and c. Other.

8) Average Revenue in Cents per KWH Sold: a. Residential; b. Commercial and Industrial; and c. Other.

9) Average Operating Expense in Mills per Total KWH Sold: a. Production, for fuel and other costs; b. Transmission; c. Distribution; d. Customer Accounting and Collecting; e. Sales Promotion; f. Administrative and General; and g. Total Operating Expense.

10) Customer Accounting and Collecting Expense in Dollars per Customer.

11) Sales Promotion Expense in Dollars per $100 Reserve.

12) Administrative and General Expense in Dollars per $100 Revenue, etc.

This list could include ratios for comparing sub-divisions of the above, such as the annual cost of meter reading per customer, etc. By analytical comparison of a sufficient number and variety of such ratios, a clear picture may be obtained of past efficacy of the management, operation and maintenance of a given utility; and possible, desirable, or essential changes in system operations and policies will become evident, leading ultimately to improved operation, greater efficiency, and sounder financial condition of the given utility.

• • •

Disease of Pin Oaks Controlled

Chlorosis, a disease which causes the yellowing of the foliage of pin oak trees due to an insufficient supply of green chlorophyl, has been controlled by the use of iron chelate salts by the Roadside Development and Maintenance Dept. of Wayne County, Mich. This chemical adds iron to the soil in an available form which is necessary for the formation of chlorophyl in leaves. It was applied in quantities of 1 to 3 lbs. per tree to the soil in conjunction with light-spray applications to the leaves for immediate stimulus. In 1958, 222 pin oak trees were treated with 420 lbs. of iron chelate. Trees which were treated similarly in the past 3 years are now growing vigorously and show no symptoms of the disease.

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engine power
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Get dependable prime or standby

A Turbocharged Caterpillar D397 Series D Mobile Electric Set supplies standby power in case of commercial power failure in town of 18,000. Cat V12 Diesel Electric Set powers two 150 HP electrically operated pumps and all other plant electric services.

CATERPILLAR V-TYPE ENGINES are made for heavy work like pumping. Everything that goes into their design and construction has been tested and proven for toughness and dependability.

Whether you're looking for prime power to give years of around-the-clock service or standby power to keep water flowing when outside power fails, you can rely on Cat V-type Engines. Some have been in regular service for 20 years and more. And there's no sign yet that they're ready for retirement. That's what we mean by dependability when we talk about Cat Engines.

With dependability come other advantages. You don't need premium fuels with Cat Engines. You don't have to baby them with elaborate care. Regular maintenance is all that's required. And routine service is easy to perform. Parts when you need them are always available from your nearby Caterpillar Dealer.

Your Caterpillar Dealer will be glad to show you how his engines can increase the security of your pumping operations or other operations. He'll arrange for you to inspect nearby installations. It would be worth your while to get in touch with him. If you'd like additional data on Caterpillar Engines before you call him, please write to Caterpillar Tractor Co., Engine Division, Peoria, Illinois.

CATERPILLAR

Engine Division, Caterpillar Tractor Co., Peoria, Ill., U.S.A.

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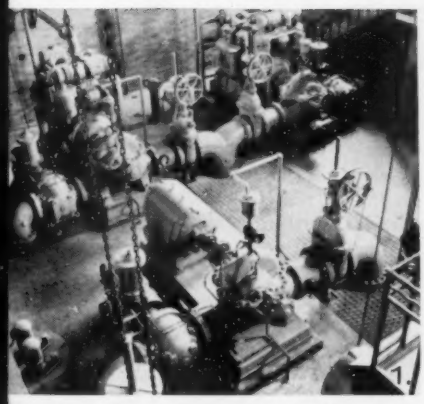
waterworks power with versatile Cat V-type Engines



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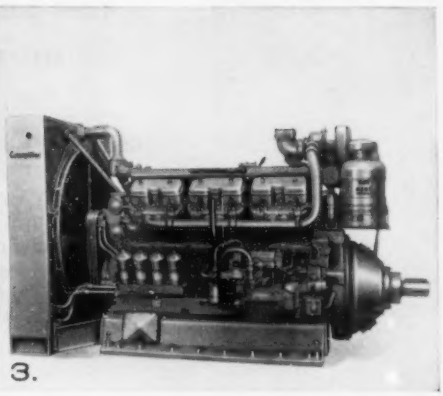

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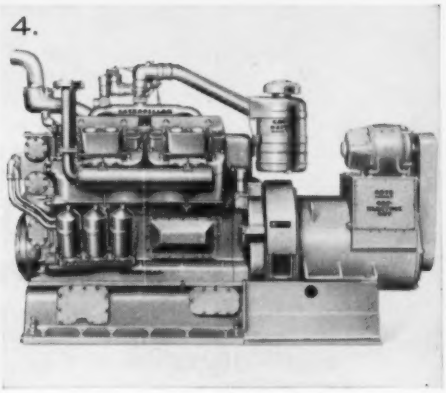

1. 50,000 domestic and industrial customers depend on this plant for water. If outside power fails, two Caterpillar D375 Diesels provide emergency pumping power. Each engine pumps 7,500,000 gallons a day, to more than meet the demand.

2. Three Cat Diesels drive pumps supplying water to towns 30 miles away. At full throttle, 24 hours per day, engines ran over 5,000 hours each in eight months. "The small expense we have had on these engines is insignificant considering the constant full load they carry," reports the city manager.

3. The V12 Turbocharged D397 Series D Engine is rated at 650 maximum HP —375 KW standby. All Cat Engines operate on low-cost diesel fuels. In terms of length of service, fuel consumption and maintenance, Cat Diesels are genuinely economical.

4. The Cat G375, the G397 and the smaller G342 are available as natural gas engines or electric sets. They will burn natural gas, sewage gas, propane, butane or mixed gases. And two ratios are offered, 7.5:1 and 10.5:1.

C.D.E.S. stands for Caterpillar Diesel Engine Specialist. He's your engine power consultant. He helps you and your municipal engineers analyze needs, select the right engine, supervise installation, provide operation guidance.

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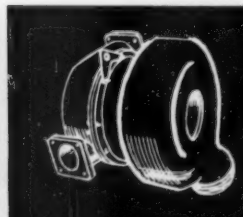
Wherever your installation is, you are close to Caterpillar parts and service. There are more than 400 domestic Cat dealers. A Caterpillar Engine never becomes a "parts orphan," no matter how old the engine is.

Turbocharging gives you higher horsepower to the pound of engine weight. Turbocharger utilizes the otherwise wasted energy of exhaust gases. This increases operating economy because fuel goes farther.



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Interested in further information, drawings or specifications? Address the American Concrete Corporation, 5092 North Kimberly Avenue, Chicago 30, Illinois.

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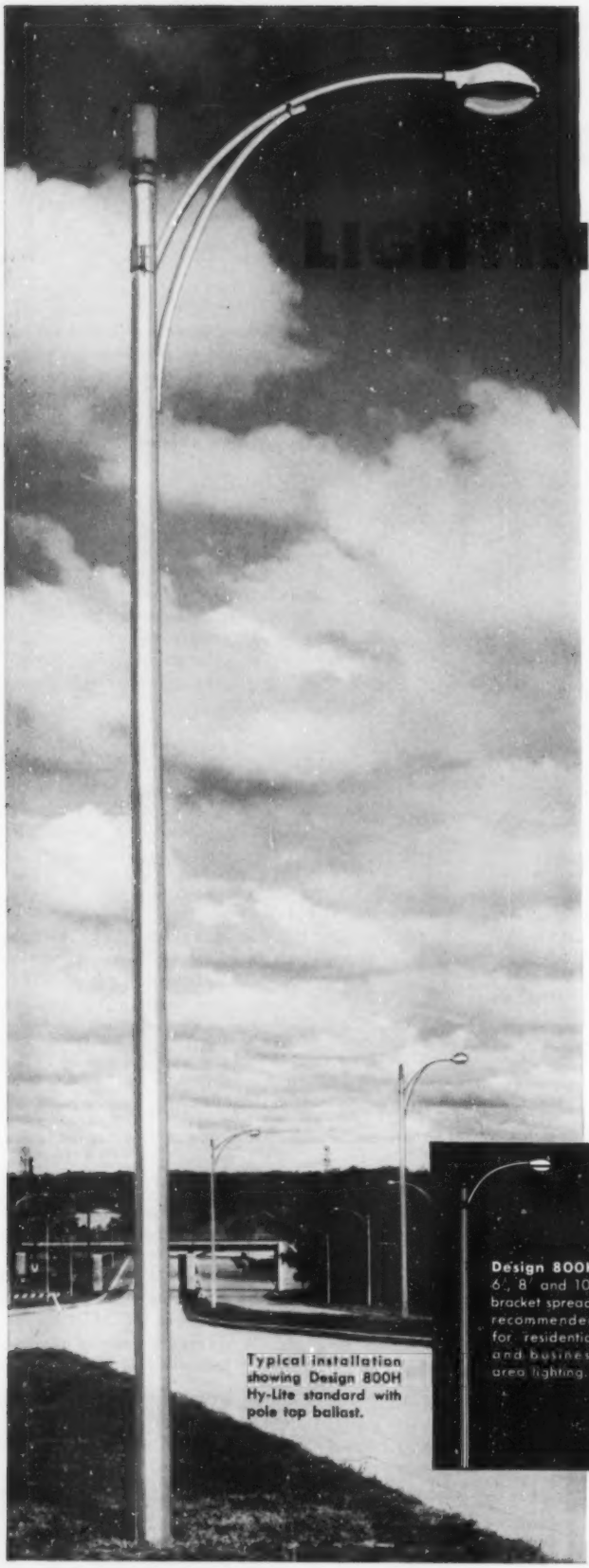

Typical installation showing Design 800H Hy-Lite standard with pole top ballast.

Design 800H 6', 8' and 10' bracket spread, recommended for residential and business area lighting.

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MODEL LST (illustrated) especially recommended for traffic control systems.

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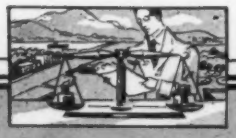


LEGAL ASPECTS OF PUBLIC WORKS

MELVIN NORD, Dr. Eng. Sci., LL.B.

A Diverting Case

Johnson v. Iowa State Highway Commission, 94 N. W. (2d) 773, an Iowa case decided Feb. 10, 1959, was an action by landowners against the State Highway Commission, which was widening and repairing a highway in the City of Des Moines, to restrain a supposedly illegal diversion of surface water onto the landowners' land through five pavement intakes.

The defendant highway commission claimed that the project, when completed, would not cause sufficient water to flow onto the plaintiff's land to do appreciable damage.

The trial court granted a decree closing three intakes on one side of the pavement, and refused to order closed the two intakes on the other side of the pavement. All parties appealed, but the Supreme Court of Iowa affirmed the decree.

Sewer Flooding

Buck v. Village of Davenport, 95 N. W. (2d) 488, a Nebraska case decided March 20, 1959, was a suit for a mandatory injunction requiring the Village to repair and maintain its sewer system so that plaintiff's property would not be flooded by it, and also to recover damages for past flooding.

According to the plaintiff's allegations, her property is connected by a lateral to the main sewer line which is located in front of her property. The lateral has an opening in the basement of her home and extends from there to the main sewer. This connection was made in 1938. The village collects and she pays a monthly sewer use charge to the village. On Nov. 21, 1955, plaintiff notified an employee of the Village whose duties were concerned with the operation and maintenance of the sewer system that there were indications on her property that the sewer was becoming obstructed. The village made no effort to ascertain the condition of the sewer or to correct it, and it became completely obstructed for 8 hours, 3 days later. The contents of the sewer backed up, entered, and flooded the basement to a depth of about 2 feet. The floor and walls of the basement were covered with filth which gave off foul odors and noxious gases. The odors continued to permeate her house.

The trial court refused the injunction, but allowed $600 in damages.

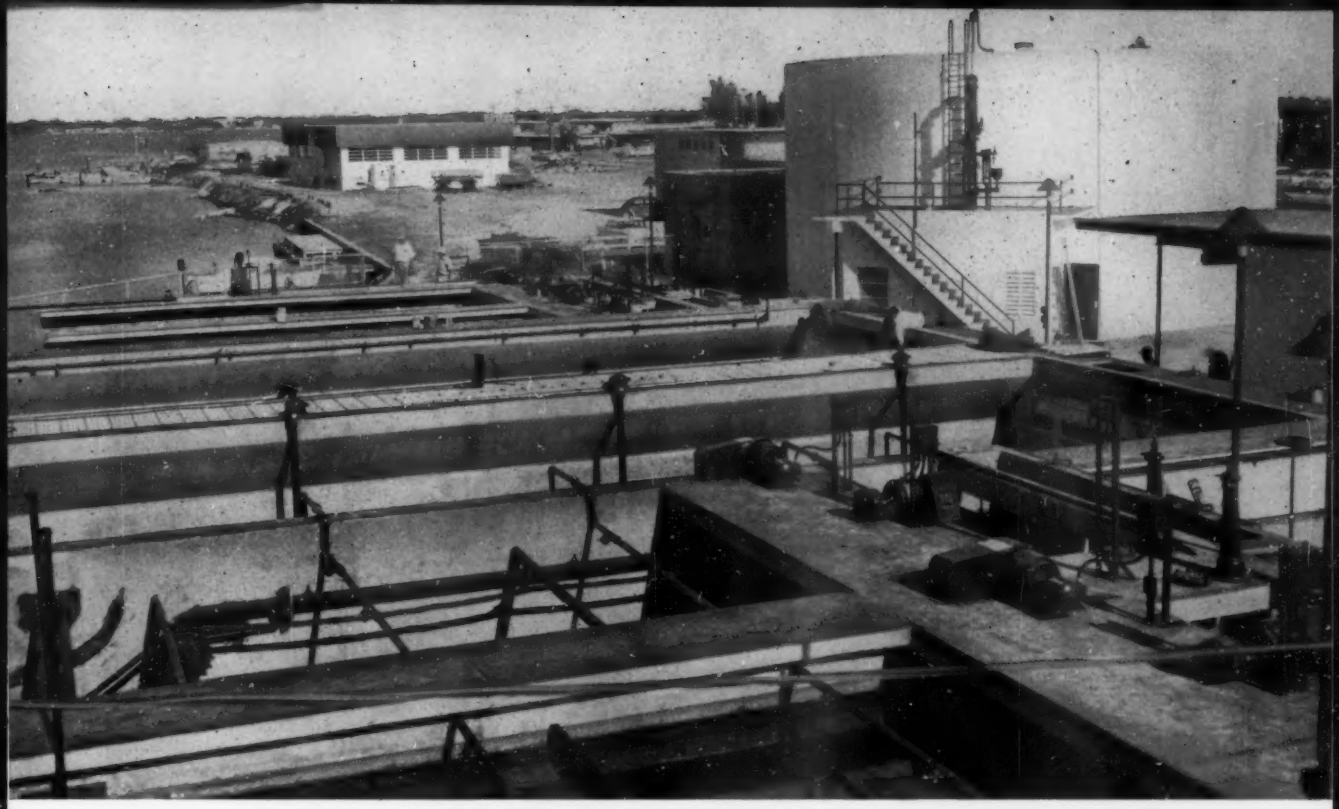
On appeal, the judgment for damages was reversed for retrial before a jury, on procedural grounds.

Assignability of Contracts

Tullgren v. School District No. 1 of the Village of Whitefish Bay, 95 N.W. (2d) 386, a Wisconsin case decided March 3, 1959, was an action for breach of contract for architectural services to be provided the School District.

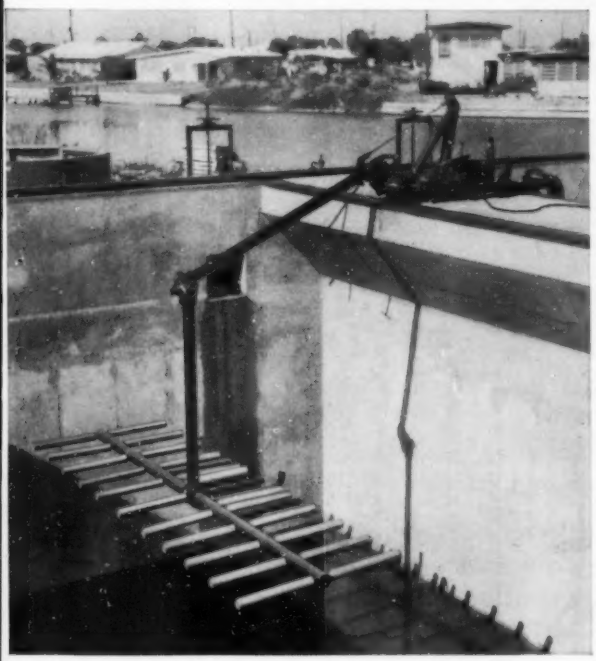
In 1929, the School District desired to construct a new high school building, and entered into a contract with Tullgren, a licensed architect, to draft and prepare plans for the building. Because it was impossible for the district to finance the cost of construction of the entire building, it was divided into five separate units. It was provided that Tullgren was to be paid 2 percent of the estimated cost of the building with additional fees to be paid for the performance of the usual incidental services.

Prior to 1931, the district had paid Tullgren $35,000. At that time, the agreement was modified in certain respects, including a new provision that in case of the death or incapacity of Tullgren he or his personal representative would have the right to assign his interest in the contract to a competent and ex-



More than five miles of extra heavy galvanized Wrought Iron Pipe, from 1½-inch to 3½-inch, were used in the construction of the Treasure Island, Florida, Sewage Collection Plant.

Wrought Iron Pipe provides a bulwark against corrosion at Florida's Treasure Island Sewage Treatment Plant



Included in this system are eight pneumatic ejector lift stations which are supplied with compressed air transmitted in Wrought Iron Pipe from the blowers and storage located at the Treatment Plant.

Compressed air piping used in the activated sludge process must provide maximum operating life, minimum maintenance.

At the new Treasure Island, Florida, Sewage Treatment Plant, consulting engineers specified corrosion-resistant Wrought Iron Pipe for this service. Severe internal corrosion and clogging from loose rust occur with ordinary piping materials in this service. But not with Wrought Iron. Its corrosion product is dense and highly adherent, and actually *protects* the underlying metal from further corrosive attack.

Today, specifiers and plant operating men are getting a Wrought Iron that is the most versatile material yet developed to help fight corrosion. New 4-D Wrought Iron faces corrosive attack with far greater resistance, even, than standard Wrought Iron, its dependable predecessor.

4-D was achieved by substantially increasing the deoxidation of the base metal, slightly increasing the phosphorous content and using a more siliceous iron silicate. 4-D is available now from your distributor. Write us for new 4-D Wrought Iron literature. A. M. Byers Company, Clark Building, Pittsburgh 22, Pa.

City of Treasure Island Sewage Plant Improvement
Consulting Engineers: Gilbert W. Clifford & Associates
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If you are an officer of a municipality or a governmental unit, talk to the people at Chase Manhattan about your trusteeships. The address is 40 Wall Street, New York 15. The telephone number—HAnover 2-6000.

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perienced school building architect approved by the district, provided the assignee would agree in writing to carry out all the terms of the agreement.

Tullgren died in 1944, and his widow was appointed his executrix. As such, she assigned Tullgren's interest in the contract to another architect, Herbst, in accordance with the contract. In a separate agreement with Mrs. Tullgren, Herbst agreed to carry out all the terms of the contract, and agreed to pay her a percentage of the fees he would earn. This agreement also provided that if the school district breached the contract with Herbst, she could bring a breach of contract action against the district if Herbst chose not to do so.

Mrs. Tullgren subsequently brought suit against the district, deeming they had breached the contract with Herbst. The school district argued that she had no right to bring such an action, since liability to her under contract between the district and Tullgren had been discharged by its contract with Herbst, and that her action, if any, would have to be against Herbst.

The Supreme Court of Wisconsin held that she had a right to maintain the action against the school district if they had actually breached the contract. Normally, such contracts are not assignable, but this contract was assignable by its own terms. Furthermore, the assignee, Herbst, was not given any power to assign further or to revoke the contract. Therefore, it was not possible for Herbst and the school district to revoke the contract and cut off Mrs. Tullgren's rights.

In other words, the nature of the contract between Tullgren and the district and the nature of the assignment to Herbst were such as to leave Mrs. Tullgren with certain rights under the contract, including maintaining a suit of this type.

Design and Planning Methods Being Improved

Continuous study of design and planning methods is conducted or supervised by the office of the Engineer of Design, Department of Public Works, Los Angeles, Calif., resulting in improvement, simplification or clarification of these methods. To this end, new standard plans, decals and rubber stamps are continually being developed to reduce drafting and engineering time. Standardized instructions are being issued from time to time to promote uniformity of practice and to define policies.

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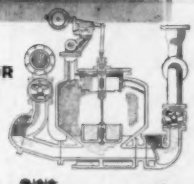

Twenty-Five Year Warranty

Subject to the limitations herein contained, YEOMANS BROTHERS COMPANY warrants its mechanically-controlled Shone Pneumatic Ejector against defects in workmanship and materials under normal use and service for twenty-five (25) years after installation as specified in factory recommendations. The Company's responsibility under this twenty-five year warranty is limited to replacing or repairing without charge, f.o.b., its works, any of the following components: sewage (or waste) receiver, mechanical air and exhaust control and the Shone inlet and discharge check valve. All other parts are subject to the manufacturer's warranty of one year.

Written notice must be given to the Company immediately upon discovery of any defect. The Company shall have the option of requiring the return of a defective component or material, transportation prepaid, before accepting a claim. In no event shall YEOMANS BROTHERS COMPANY be responsible or held liable for delay or damages of any kind or character resulting from or caused directly or indirectly by any defective component or material. This warranty shall not apply to any component or material repaired or altered outside of the Company's works unless the Company's written approval in that respect is first obtained and no allowance will be made for such repairs or alterations without the written consent or approval of the Company.

This Warranty is in lieu of all other warranties, expressed or implied, and is in lieu of all other obligations or liabilities on the part of the Company. No other person is authorized to vary the terms or provisions hereof in any respect.

YEOMANS BROTHERS COMPANY
D. W. Burgoon
PRESIDENT

SERIAL No. OF UNIT

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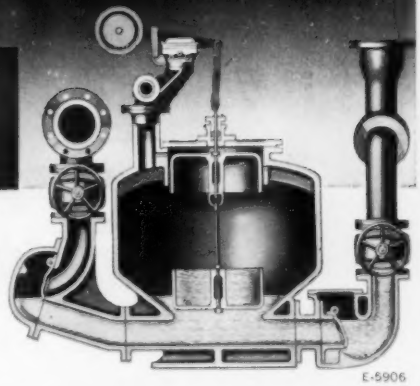

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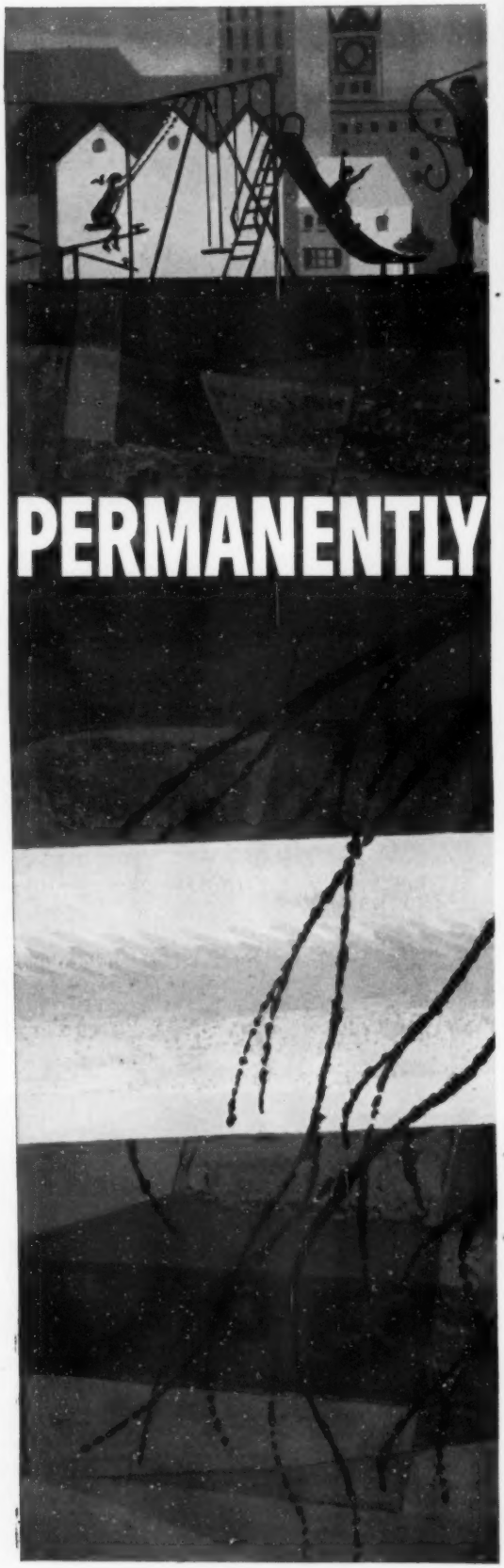

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10	1500	2400	3300	4000	5000
12	1500	2400	3300	4000	5000
14	1500	2400	3300	4000	5000
16	1500	2400	3300	4000	5000

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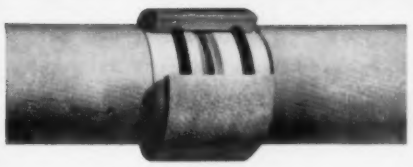

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PUBLIC WORKS MAGAZINE

Volume 90, Number 6

CIVIL DEFENSE and the ST. LOUIS TORNADO

PAUL A. STEINBICKER,
Civil Defense Executive,
St. Louis, Missouri

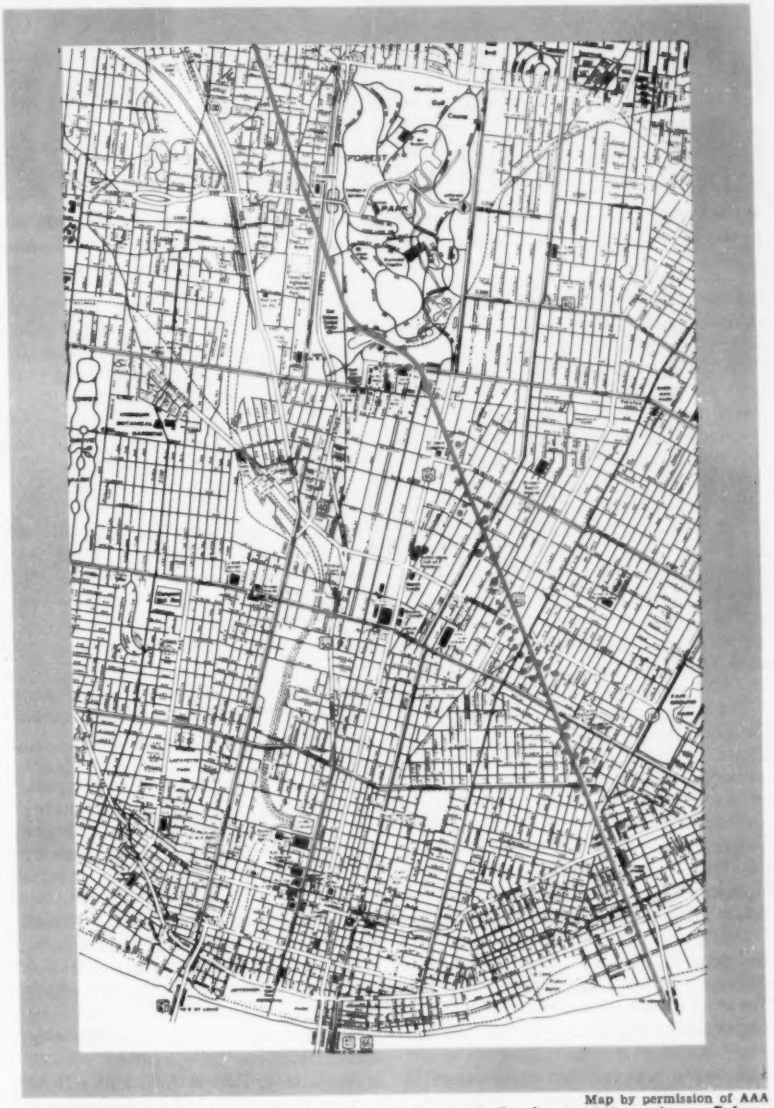
AT TWO in the morning, February 10, 1959, conditions in St. Louis were somewhat normal, following an earlier near-torrential rainstorm, but this had been indicated in bulletins by the Weather Bureau. Temperatures continued mild. There was no concern about any more serious condition.

At 2:12 am, disaster struck. A deadly tornado had formed out of the right combination of atmospheric conditions. It had dipped briefly about 60 miles southwest of St. Louis and proceeded northeastward dipping to earth intermittently in the suburban area near the city. Wreaking havoc on its way, the twister hit with full force in the Hampton-Oakland area and tore a path northeastward across Forest Park. It then proceeded full force into an area beginning north and east of Kingshighway and Forest Park Boulevard, giving up only when it reached the Mississippi in the vicinity of McKinley Bridge.

The devastation, though less than from the 1896 or 1927 tornadoes, was still fearful. Twenty-one persons lost their lives. More than 400 were injured, 69 of them seriously enough to require hospitalization. Nearly 2,000 buildings were damaged, including 47 destroyed and 256 sustaining major damage, with property damage estimated by the Insurance Board of St. Louis at about $12,000,000. More than 3,000 families were directly affected by the tornado.

Previous Preparations

Though there was no advance preparation for this specific tornado,



Map by permission of AAA

● **COURSE of the disastrous tornado which struck St. Louis, Missouri, on February 10, 1959. Red dots represent points of destruction along the path of the storm.**

St. Louis was not caught unaware. The Office of Civil Defense, acting under its authority to function in a natural emergency, had developed a coordinated natural disaster plan as early as 1953. This plan, modified and tested in the intervening years, was founded on the principle that the Civil Defense Office would play no operational role in an emergency, but would be limited to the functions of planning and coordination under the direction of the Mayor.

In the spring of 1958, a complete test of the plan was carried out. Even more recently the City Street Department, which under the Natural Emergency Plan is one of the operational services, ran successfully through two service exercises. It should further be emphasized that in all major aspects, the execution of the plan is largely automatic. In other words, each service can and should go into operation as soon as, and insofar as, the immediate situation demands, without waiting for other elements or other services.

This is generally the way in which the plan functioned in the pre-dawn hours of February 10. One aspect, however, did not function exactly as envisaged. Provision was made for communication of a tornado warning from the St. Louis office of the U. S. Weather Bureau to the Superintendent of the Fire and Police Telegraph Section, St. Louis Fire Department. It then became the responsibility of the Superintendent to notify the Civil Defense Director or a member of his staff. Regrettably, the tornado of February 10 came without advance notice; there was no warning issued by the Weather Bureau.

Under these circumstances, for a considerable period after damage reports and calls for help came to the Fire Alarm Station, the two men on duty, taken up as they were with expeditious handling of the calls, realized only that the calls were more numerous and serious than usual. When the calls kept coming, they concluded, still with no official notice from any other source, that the situation was serious enough to alert the Superintendent. This was done, about 3:30 am. In very short order, he realized that the increasing calls for help indicated a major disaster. He then called the Civil Defense Director and the provisions of the plan for alerting the rest of the organization went into operation. The Director first called Mayor Tucker who notified the civil defense staff. The Civil Defense Office was prepared to operate in a very short period. About 6 am the Mayor arrived at the Control Center and assumed active direction of the emergency operations. With the Mayor and his civil defense staff, there were also assembled nearly all the service chiefs or their representatives.

The Civil Defense Control Center in Forest Park was itself in the path of the tornado, and sustained material damage. Nevertheless, despite several hours of discomfort prior to the making of basic repairs, it was in operation.

Although it took about three hours to get the control center activated, the prepared plans of the operating services went into effect with no loss of time. The Police and Fire Departments and the two city hospitals were in operation almost immediately. Police, fire, and public utility logs show that all reacted quickly at 2:14 am. Police car calls began to come in over the police radio, and action began right away. At 2:15, the Fire Alarm Center began to respond to specific calls for help. At 2:18, the Union Electric Company dispatcher notified the general foreman of trouble at the Enright Avenue substation, and utility operations began. Soon all emergency channels were choked with calls, but action followed as rapidly and in as orderly a fashion as the circumstances permitted.

● MAYOR, Civil Defense staff and Service Chiefs assembled at the CD Control Center by 6 AM on morning of the tornado.

● REMNANTS of TV tower blown down by tornado are being removed by workmen. No one was seriously injured by fall.

Services Activated

About 450 policemen were on duty when the tornado struck, with 269 police vehicles on the street. By 2:20 am the Acting Night Police Chief had notified the Fire Department, issued emergency orders to his skeleton staff of 18 to notify the top command, to alert all district commanders to report for duty and to order all men on duty to remain on duty until further notice. By 8 am, over 1,000 police were on duty, with nearly 400 radio equipped vehicles in the field.

The same was true of the Fire Department. The men on duty, many trained especially in rescue operations, began immediately to remove persons from damaged buildings and to undertake other rescue and salvage operations. Fortunately, the only fires resulting from the tornado were small.

In appropriate chronological order, and without loss of time, the various other services swung into operation according to existing plans. The city ambulance dispatcher was notified by 2:30 as were the Street Department, Forestry Department, utilities, hospitals, and other services. The Hospital Service turned in an excellent performance. As the casualties were brought to

the hospitals all hands were pressed into emergency duty; in short order the necessary additions to staff were summoned and patients treated as necessary. The Mortuary Service, under the direction of the City Coroner, also began operations early.

The Welfare Service, administered by the American Red Cross, should also be singled out for specific commendation. Very shortly after the disaster, this service was functioning. Emergency stations were set up promptly. The registration, identification, shelter, feeding, and other welfare services of the Red Cross continued as needed—with major staffing done by volunteers.

Similar accounts could be added for the other operating Services. The Street Department did a remarkably effective job in clearing streets of uprooted trees and other rubble and in establishing, in cooperation with the Police, Fire, and Utilities Services the necessary road blocks. With Forest Park sustaining heavy damage, especially from trees, the Park Department also called out all men and quickly got the situation under control. Thanks to the coordination effected between the ment, checking water and other sanitation needs, found it necessary to issue only a few orders, and reported all in normal operation by 3 pm of the 10th.

Contact was made with neighboring civil defense offices, the Governor, and the Federal Government. Aerial reconnaissance of the area was requested of the CAP at 8:30 am, and was made. At 9:10 the Director of OCDM in Washington called the Control Center, indicating the Federal facilities available to St. Louis. Thereafter, a constant two-way flow of communications kept on. Volunteers by the dozens offered personal help and equipment. They included Explorer Scout Posts, veterans' organizations, state and federal agencies, and individuals. Other cities called in for reliable information; press and radio representatives came, and stayed.

Thanks to the coordination provided by the Civil Defense Control Center, it took only minutes in the morning of February 10 to conclude arrangements for having the Missouri National Guard furnish a minimum of 160 men to aid the police in standing guard in the damaged areas during the nights of February 10 and 11. Thanks to the same facilities, many precious minutes were saved in having 500 cots from Scott Air Force Base, in Belleville, Illinois, brought by the St. Louis Parks and Streets Departments to the Red Cross emergency shelters.

keel. Of course, the scars of damaged buildings remained, and the grief of the injured and bereaved continued. At least three funds for aid of the victims were set up, and yielded a total of more than $200,000. Insurance companies, commercial establishments, and public agencies made it as easy as possible for tornado victims to avail themselves of appropriate help.

As the main outlines of the picture became clearer, those concerned with the operation of civil defense in a natural emergency could draw some logical conclusions. Though some time elapsed in getting the Civil Defense Office itself into actual operation, there was no more loss of life or property than would have been the case with earlier notice. This was mainly because the operating services could and did proceed to act immediately in accordance with the pre-arranged natural emergency plan. The Civil Defense Control Center, once in operation, functioned as the plan envisioned.

While no change whatever is indicated in any feature of the Civil Defense Plan for Natural Emergency as it applied to the opera-

● **FIREMEN, trained in rescue and salvage work and working as the Fire Service of Civil Defense clean up after tornado.**

● **STREET scene illustrating damage by tornado. Police service had 1,000 men patrolling the area by daylight of Feb. 10.**

Streets Service and the Transportation Service, the busiest streets, both within the outside Forest Park, were ready for the morning rush hour traffic when it came. Thereafter, most traffic congestion came from sightseers.

The main task of the Communication Service, alerted by the police at 2:30 am, was to re-establish wrecked telephone communications. Repair crews were rapidly sent out and by 3 pm on the same date over 5,000 of a total of 7,000 dead phones were back in service. The Health Depart-

Aftermath

Gradually, the pace of activity slowed down. Reports came in, starting at 1:48 pm, indicating that the situation was returning to normal. By noon of the following day, St. Louis was back on a normal

tional services, study should be concentrated on two features of the plan as it concerns the Office of Civil Defense and its responsibilities. The problem of alerting the public of an impending emergency during the night should be considered, even though this item made no difference in this case because there was no warning. Also deserving of consideration is the problem of providing numerous alternate means for advising the Civil Defense Director more promptly of any developing emergency.

SEWAGE TREATMENT PLANT WILL GROW WITH POPULATION

J. L. ROBINSON,
Assistant Superintendent,
Water and Sewage Treatment,
Fort Worth, Texas

● ON A SITE of 120 acres, this plant can be enlarged from present 5 mgd capacity to 120 mgd without abandoning any of the original plant structures.

FORT WORTH has planned for the future with the location and construction of its new Village Creek Sewage Treatment Plant. Prior to 1950 the city officials could see that the City was expanding in every direction and that it was going to be necessary to have a master plan for sewage collection and treatment facilities.

The engineering firm of Freese and Nichols was employed to study the problem. The major portion of the sewage was treated at the 30-mgd trickling filter Riverside sewage treatment plant, located on the West Fork of the Trinity River about three miles from the downtown business district. All of the property at this plant site had been utilized and the plant did not lend itself to further expansion. Then, too, the residential area continued to develop toward the plant.

The eastern portion of the City is in the Village Creek basin which drains into the West Fork of the Trinity River about 8 miles downstream from the Riverside Plant. Since it was not feasible to return the sewage to this plant, the engineers recommended that a new plant be built at the confluence of Village Creek and the Trinity River. A site of about 120 acres was acquired and a contract was let for the preparation of plans and specifications for a 5-mgd plant.

The location of the plant, the possibilities of it becoming a major plant in the future and of the future use of the sewage effluent for an industrial water, as well as the ever-increasing need for a better sewage plant effluent entering the state's streams, dictated the selection of the conventional activated sludge process with two-stage sludge digestion.

Through the work of O. C. Allen, Design Engineer of Freese and Nichols, the planning was such that the plant could be systematically enlarged to 120 mgd without abandoning any of the original units.

Since the plant site is in the flood plain of the Trinity River, it was necessary to provide levees around a portion of the area. To have enclosed all of the site at this time would have required a large expenditure for storm drainage pumps. An area of about 38 acres, which is large enough to expand the plant to 40 mgd was enclosed with levees.

Primary Treatment

A 54-inch concrete line brings the sewage from the eastern portion of the City into the plant site. The sewage then flows through a 36-inch Parshall flume and a Jeffrey inclined back raked screen with 1-inch clear openings, designed for a maximum flow of 30 mgd. The screenings are shredded by a Jeffrey 1300 lb./hr. grinder. An emergency, hand-cleaned bar screen is adjacent to the above unit. The grit is removed by a 26-ft. square Process Engineers grit separator equipped with an organic solids return mechanism.

Preaeration and primary settling occur in two Process Engineers Oxidators, 80 ft. in diameter and 6½ ft. deep. A central compartment, 46 ft. in diameter is used for aeration. Since the outfall sewer is so long, it was thought that pre-aeration might be helpful. Each unit has a capacity of 5 mgd, with a 69-minute detention period at that rate.

Two of these units were constructed to provide alternate use as needed. The No. 1 unit was arranged to serve as a final clarifier in case of mechanical failure of the single final clarifier, with the sludge piping in this unit oversized to take care of the activated sludge. Primary sludge is withdrawn through American Well Works telescoping valves to the wet well of the primary pump station.

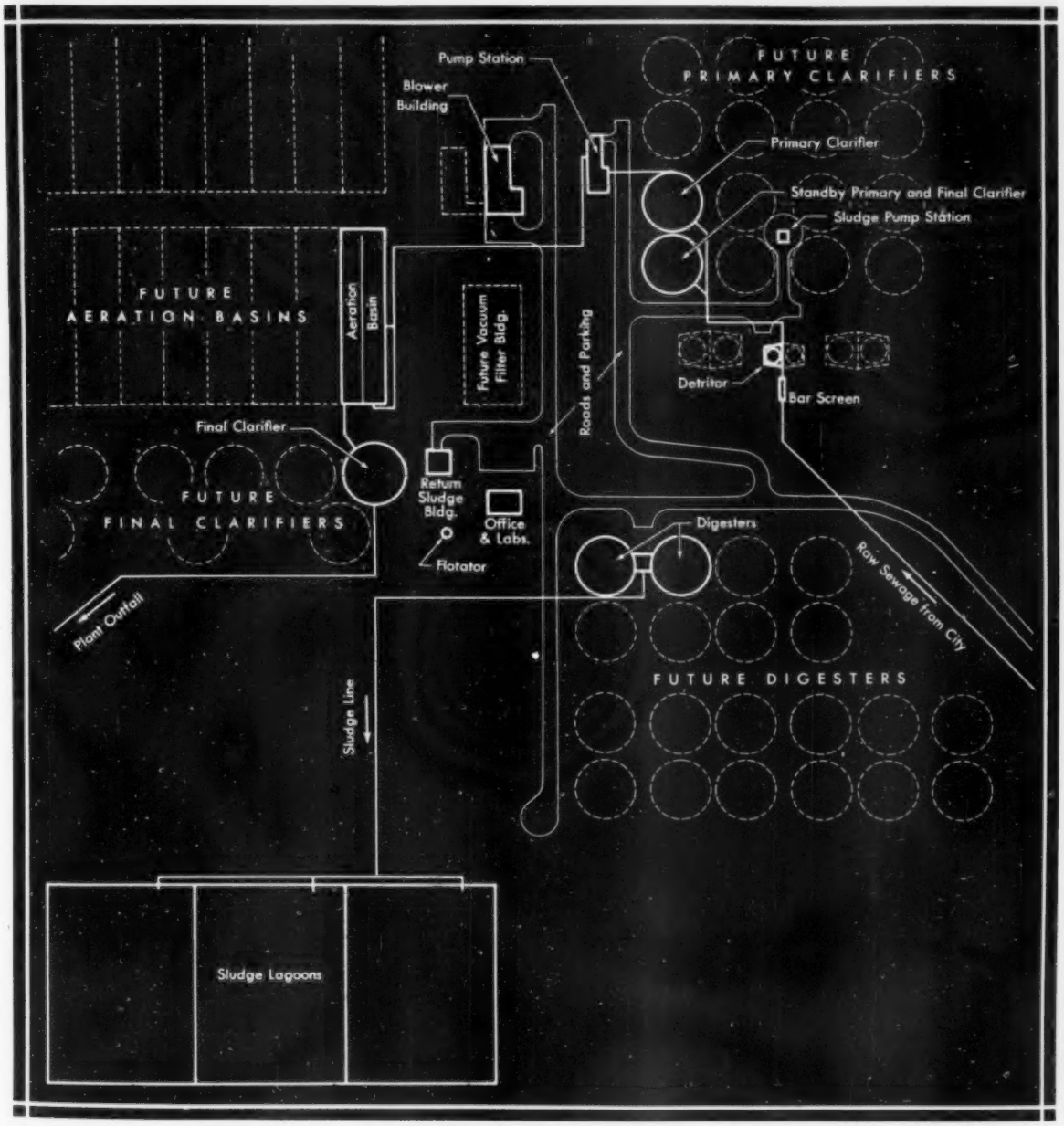
The primary pump station is so located that it can serve eight primary tanks when the plant is enlarged. The primary sludge is han-

dled at this point by two 200-gpm Chicago Scru-Peller pumps for discharge to the Process Engineers Flotator for thickening, or to either digester.

Secondary Treatment

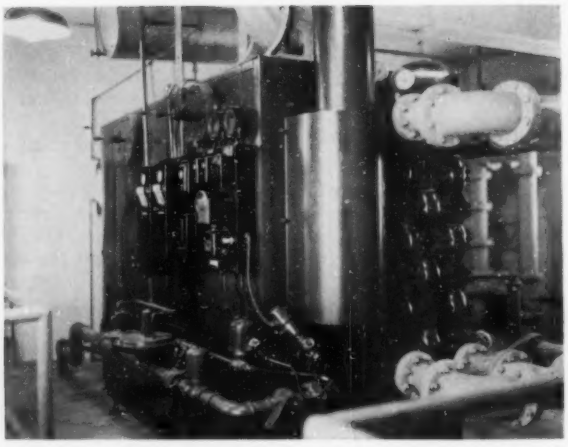
The settled sewage passes on to the wet well of the main pump station. Worthington volute pumps are used to lift the sewage through a venturi tube to the aeration basin. One unit has a capacity of 1750 gpm at 30 ft. tdh, and two have a capacity of 3500 gpm at 30 ft. tdh each. The pumps are in the basement and the motors are on the main floor of the station. These pumps may be operated manually or by Charles F. Warrick electrode type liquid level controllers, which program the pumps to match the sewage flow. Space was left for a larger future pump in the station.

The storm drainage pumps are also in the main station. These are two 16,000-gpm (35 ft. tdh) Fairbanks-Morse mixed flow pumps driven by 250 hp natural gas or gasoline Le Roi engines. There is also an electrically driven 1500-gpm (40 ft. tdh) Fairbanks-Morse mixed flow pump which works on manual or automatic liquid level control. Space was set aside and fittings were placed for a third 16,000-gpm



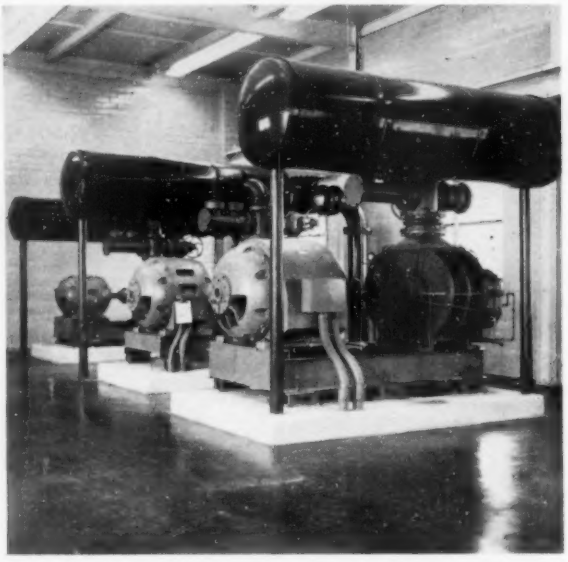
● **GENERAL LAYOUT of Fort Worth's Village Creek sewage treatment plant. Heavy solid lines represent units that have been constructed; light broken lines show provisions for future expansion. Existing air lines and the by-pass sewer have been omitted. The site is actually far more extensive than shown here, and provision is made for 8 more primary clarifiers and 16 more final clarifiers than indicated above. In addition, there is space for a total of 24 aeration basins.**

● VIEW of the main laboratory which is completely equipped for all the necessary analytical and plant control procedures.



● EXTERNAL sludge heater is located in digester control room between the two 80-ft. digesters, capacity 5 cu.ft/cap.

● AERATION basin. Dimly seen in the background are the digesters at far left; the office and laboratory next, and return sludge pump building. Final clarifier is shown in background.



● BLOWER Building interior showing three blowers. Inlet snubbers are in basement under blowers; discharge snubbers are mounted on top of blowers. Room has red floor, tile walls.

pump when it is required. The chief operator's office and instrument panel is also in this building.

The settled sewage enters the end of the two-pass spiral flow basin which is 30 ft. wide, 15 ft. SWD and 250 ft. long and is provided with tapered aeration. The basin has Chicago Pump swing diffusers equipped with Saran cord wrapping. The basin has a detention time of 8 hours for a 5-mgd flow. Settled sewage can be introduced 125 ft. from the inlet of the basin, with the first portion of the basin used for reaeration of the return activated sludge. This modification was provided so that the City may determine if there is an advantage of one method over the other.

To provide a wide range of air volume, three Sutorbilt blowers driven by GE motors were selected with two of them having slow speeds. The capacity is 2960 cfm at 7.75 psig for the large one; and the capacity ratios at slow and fast speeds for the other two are, respectively, 1480/3530 cfm and 1940/4140 cfm. These blowers will provide 16 different rates of air injection from 1480 to 10,630 cfm. The maximum air capacity is 3 cfm/gal. at 5-mgd. The blower building was made large enough to take care of two larger blowers for future installation. Air is filtered through a primary Roll-O-Matic filter and then through Airmat Type PL-24 paper filters, all made by American Air Filter Co. The blowers are equipped with Burgess-Manning suction and discharge snubbers. The blower building also provides space for the maintenance shop, a shower and locker room and a lunch room for plant personnel.

The mixed liquor from aeration flows into the 85-ft. by 9-ft. SWD circular final clarifier provided with Process Engineers equipment. At a 5-mgd rate it has a surface loading of 900 gal./sq.ft./day and a detention period of 110 minutes.

The final effluent is discharged into the manhole structure of the 54-in. outfall line. Chlorine can be added at this point by two Wallace and Tiernan 400-lb./day chlorinators. The effluent flows through 1400

feet of outfall line to the Trinity River.

Sludge Handling

The activated sludge is withdrawn from the final clarifier through a telescoping valve and flows into the wet well of the return activated sludge pump station. Pumping is provided by three Worthington volute pumps, one of 350 gpm at 18 ft. tdh and two having capacities of 600 gpm at 18 ft. tdh. Each pump motor has a rheostat with 13 speeds so that there is a wide range of capacity available for returning the sludge to the aeration basin.

Waste activated sludge can flow by gravity back to the raw sewage or it may be pumped by a Marlow sludge pump of 125 gpm at 45-ft. tdh to the digester, or it may be pumped to the Flotator by a Fairbanks-Morse 125-gpm centrifugal pump for the purpose of thickening.

The Process Engineers Flotator is a 9-ft. by 6-ft. SWD circular sludge thickener of the air flotation type. The unit can be used to treat waste activated sludge, primary sludge or supernatant from the digester. The sludge from the Flotator is pumped to the digesters and the underflow returns to the raw sewage.

Two 80-ft. by 21-ft. 7-in. SWD circular digesters are piped for stage digestion. The floating covers were furnished by Pacific Flush Tank Co. The No. 1 digester is equipped with a 150 cfm P. F. T.-Pearth gas recirculation system. The P.F.T. external sludge heater has a capacity of a million Btu per hour. The recirculating pump is a 300-gpm Chicago non-clog pump. The waste gas burner and digester appurtenances were furnished by P.F.T. The capacity of digesters was determined on the basis of 5 cu.ft./-capita. The supernatant can flow by gravity to the Flotator or to the raw sewage or it may be pumped to the sludge lagoons.

The digested sludge will be pumped to earthen sludge lagoons by a 240-gpm at 45-ft. tdh Marlow pump. There are three earthen lagoons with a total surface area of about 2.8 acres which are about 6 ft. deep.

Simplex transmitters and totalizing, indicating and recording instruments are used to measure the raw sewage flow, the settled sewage flow, the air flow, waste activated sludge, and supernatant or primary sludge to the Flotator.

A Foxboro 4-in. magnetic flow meter is used to meter primary sludge, and another 4-in. unit is used to measure the digested sludge. An 8-in. meter is used for the return activated sludge. The gas from each of the digesters, and the gas to the waste gas burner are metered by units made by Rockwell.

One of the finest year-around air conditioned laboratories was detailed by W. S. Mahlie, Superintendent of Water and Sewage Treatment. The building is 50 ft. by 32 ft. and is available for performing any test which may be required at a sewage treatment plant. The 8-ft. by 7-ft. "walk-in" BOD room provides adequate space for the samples, dilution water and reagents, as well as a space to prepare and titrate the samples in this room. The gray metal laboratory furniture was supplied by Kewaunee and gives adequate working areas as well as sufficient storage space. This building houses an office for the superintendent and the chemist in charge of the plant.

The building exteriors are faced in cream colored and red brick. All of the interior walls are tan glazed tile and the window units are aluminum. The pump and blower building floors have red Master Plate topping; the laboratory has terrazzo. The digesters are faced with red brick veneer, with an air space between the concrete and brick for insulation. Color coding of the piping was carried out in all of the buildings. All of the above details help with plant maintenance and appearance.

The chief chemist and plant foreman, W. A. Corder, was at the plant for almost the entire construction period and became familiar with all phases of the plant as it was built. In September, 1958, no abnormal amount of difficulty was experienced placing the plant into operation.

Cost Data

The cost of this plant at first glance would seem to be excessive, but one must understand that even though this is called a 5-mgd plant, many of the component parts were designed for much greater capacity. The land cost was about $111,600; engineering, $47,700; and construction, $1.5 million. The total cost was about $1,666,300.

MANUFACTURERS OF EQUIPMENT

American Air Filter Co.:
Blower intake filters

American Well Works:
Telescoping sludge valves

Burgess-Manning Co.:
Blower snubbers

Chicago Pump Co.:
Sludge pumps
Air diffusers

Fairbanks, Morse & Co.:
Sludge pump
Storm drainage pumps

Foxboro Co:
Magnetic flow meters

General Electric Co.:
Blower motors

Gifford-Hill Pipe Co.:
Concrete pipe

Inertol, Inc.:
Paint for piping and equipment

Iowa Valve Co.:
All gate and check valves

Jeffrey Manufacturing Co.:
Mechanically cleaned bar screen
Screenings grinder

Kewaunee Manufacturing Co.:
Laboratory furniture

S. P. Kinney Engineers, Inc.:
Butterfly valves

Manning, Maxwell and Moore, Inc.:
Overhead cranes and hoist

Marlow Pumps:
Sludge pumps

Pacific Flush Tank Co.:
Digester covers
Digester appurtenances
Gas recirculation system
Sludge heater
Waste gas burner

Process Engineers, Inc.:
Final clarifier equipment
Flotator
Grit separator
Oxidators

Rockwell Manufacturing Co.:
Gas meters

Rodney Hunt Machine Co.:
Sluice gates

Simplex Valve & Meter Co.:
Transmitting, indicating and recording equipment

Sutorbilt Corp.:
Blowers

U. S. Pipe and Foundry Co.:
Cast iron pipe and fittings

Wallace and Tiernan, Inc.:
Chlorinators

Charles F. Warrick Co.:
Liquid level controllers

Waukesha Motor Co.:
LeRoi engines

W-K-M Manufacturing Co., Inc.:
Plug valves

Worthington Corp.:
Sewage pumps

COMPRESSION TYPE JOINTS SPEED SEWER CONSTRUCTION

UNDER WAY in Millcreek Township, Erie County, Pennsylvania, is a $4,000,000 sanitary sewer project. This job would cost about one-third more were it not for the use of a new compression type joint, heat-cured-on; also the vitrified clay pipe is delivered with new packaging methods, and in longer lengths. "There's no question about the ease of installing this modern clay pipe," said Edward S. Mando of Erie, who has some $897,000 worth of contracts in two divisions of the work. "A few years back we needed at least two more men in the trench to do the same amount of pipe laying that we are doing now. The new compression type joints permanently installed on the pipe at the factory are easier and faster to lay. Since labor is our big cost, this means we can bid lower. Faster work also means less inconvenience for residents."

This Millcreek Township project covers about 15½ square miles, and nearly 45 miles of sanitary sewers are being installed. Consoer, Townsend & Associates are consulting engineers for the Millcreek Township Sewer Authority.

The new compression joints speed up the job and reduce costs, according to Fred Gorenflo, resident engineer: "This is important in view of the high water table. Much of the work is being done in water-bearing sand and gravel, and fast installation must go along with suitable trenching and dewatering to get the job done satisfactorily."

Most of the pipe installed was of 8-in. diameter in 4-ft. lengths. The larger pipe (12-in. and 18-in. diameters) was used in 2, 3, and 4-ft. lengths. The shorter sizes were used primarily at turns in the lines.

While dewatering equipment has been used on the project, most of the contractors have depended on steel boxes which they designed and had fabricated locally for permitting work in trenches that were often very wet and unstable. These steel boxes are not new, but Mando's have several interesting details. Walls of the boxes are of V-construction and are made of heavy steel plate with welded ribs for strength; ends have V-shaped or half-circle openings through which the clay pipe can be passed. Tops of the boxes have steel eyes and steel pads for lifting or

● WORKING conditions were very difficult. A steel box was used to permit workmen to make installation safely. Boxes are heavy plate with openings for the pipes

● PACKAGING pipes by strapping nine or twelve pipes together on pallet reduced breakage and cut handling and unloading costs and were "boy-proof"

lowering by digging equipment. The eyes also serve as cable connections for dragging the boxes through the trench excavations following the shovel. Mando also uses a special square box for manhole construction. At times he uses two boxes, end to end, to speed the work. He reported he installs from 125 to 190 feet of clay sewer pipe daily in 8 to 18-inch diameters in trenches up to 18 feet in depth.

Clay pipe packaging is another aid on this sewer job. On one section, contractor George Tripp of Pontiac, Mich., received his factory-jointed clay pipe on pallets that sped unloading from the trucks and permitted efficient spotting along the job site. The pallets contained nine or twelve clay pipe lengths secured to the pallet with steel straps at the factory. As with the longer lengths, the palletizing and mechanical handling expedite installation and cut costs. Use of pallets also reduces breakage and represents a safer approach to the pipe handling problem. The stacks are boy-proof and cannot endanger children or passerbys. In unloading, the heavy work is done by a highlift, or by a bulldozer, using a cable attachment at the front of the power equipment.

● **CLOSE-UP view of one of the steel boxes used by the contractor. Openings in the box ends facilitate laying pipe. Trenches were generally wet and very unstable.**

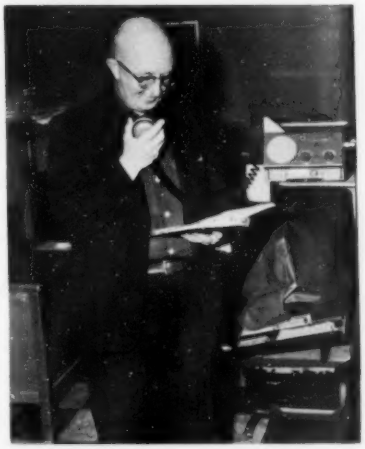
In addition, this is one of the extensive sewer projects where most of the contractors use two-way radios to speed the work. This is another step toward streamlining sewer construction, reducing lost motion, simplifying installation and keeping costs down.

ONE-CREW UTILITY DEPENDS ON TWO-WAY RADIO

PALMER SCHNEIDER,
Manager,
Cedarburg Light and Water Utilities,
Cedarburg, Wisconsin

WITH but one crew to handle all jobs in a small municipal water and light utility, communications become important to combat emergencies. That's the situation at Cedarburg, Wisconsin. A two-way radio system geared to the scope of our activities provides that communications link.

Cedarburg is a community of about 3,500 located 30 miles north of Milwaukee. The municipal electric department has a capacity of 6,500 kw. It can generate 3,500 kw and has transformer capacity of 3,000 kw for purchased power. Right now, serving both the city and township of Cedarburg, an area 10 miles in diameter, the department is peaking 5,000 kw. The water department serves the city only. Its three pump stations have a 2.75 mgd capacity.



● **THE AUTHOR operates base station in the Utility office. Unit is a 25-w. model sufficiently powerful to cover the operations in entire utility service area.**

The utility has eleven employees —three office girls, four linemen, three engineers and one relief man who works in both the generating plant and on the line truck. A total of five vehicles are operated—the manager's station wagon, the service truck, a digger, a water department pickup truck and a line truck equipped with a boom.

The manager's station wagon and the service truck get the most use, the service vehicle going to every job, in both the electric and the water department. The other three trucks are used on special jobs only.

Since the service truck will always be at every job, only it and the station wagon are radio equipped. The complete Motorola 2-way system consists of two 30-watt mobile units and a 25-watt ac utility base station. An omnidirectional antenna is mounted 45 feet above the ground on a mast on top of the one-story municipal utility building. The system operates on a power utility frequency of 158.25 megacycles. The completely installed network cost $1,626. The system provides more than adequate range, covering com-

● **THIS modern street lighting installation on Cedarburg's main street is one of complete system of street lights purchased by earnings of municipal utilities.**

pletely our service area. The radio equipment is maintained by the Motorola Service Station in Milwaukee.

Within a few weeks after installation, we felt the system had paid for itself. During this time the shovel man for a subcontractor tore out a water main. He immediately called the utility office. Since we had radio, I was able to contact my crew out on a job in time to save the city's water supply. The savings involved and, more important for a municipal owned utility, the public relationship, more than paid for the cost of the radio.

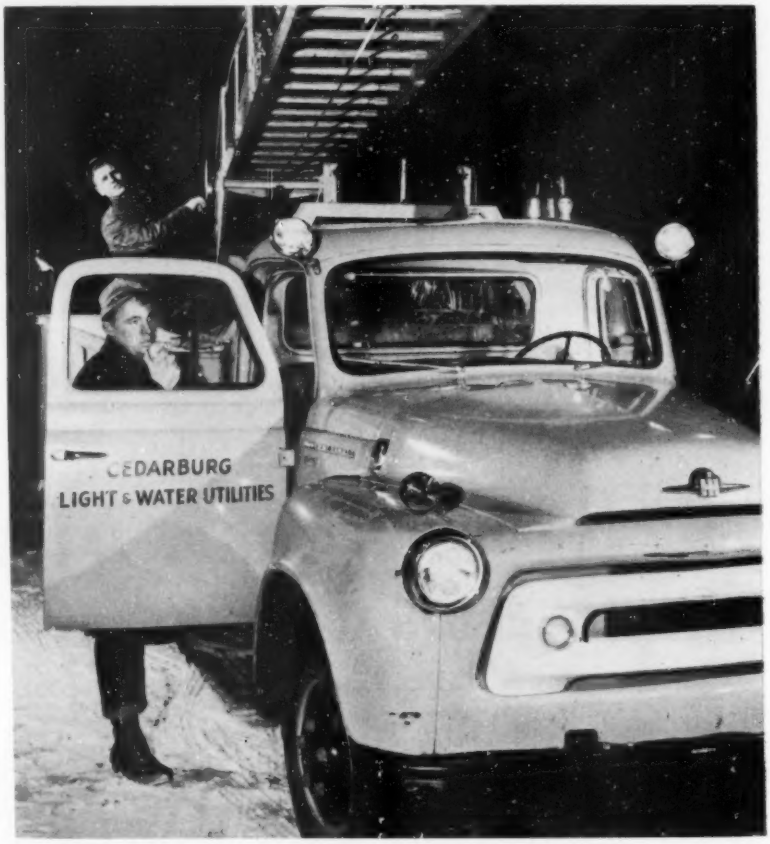
During the autumn of 1958, a large tree blew down over our power lines. With radio, we could contact the crew at once, send them for the boom truck and out to the trouble spot. Also, when men are working on the lines, they can radio in exactly when they are ready for power to be switched back on. The ability to put outages back quickly will, through the years, pay for the radio equipment by saving revenue that would otherwise be lost.

Numerous customer calls for help occur even with a small utility. While these are hardly in the emergency class, they do demand attention and can be handled with dispatch by radio communications.

The radio in my station wagon is a great help in routine business since it lets me spend more time away from the office. Any problem that might arise can be relayed to me at once. I can then head back for the office or make immediate adjustments in plans for the day. Instant action goes a long way in mollifying complainants.

The ability to provide very top notch service is quite important to the municipally owned electric utilities. At Cedarburg, the utilities have always been more than self-sustaining. Profits have taken the form of paying off part of the bond issue on the old high school gymnasium and also supplying a new mercury vapor street lighting system. But more than an impressive profit-and-loss statement is necessary to keep municipal utility owners happy since they are also the customers.

Two-way radio proves its real worth by eliminating waste time from the lone crew's schedule and making it instantly available for emergency service no matter where it might be.



● **RADIO instructions are being received by one crew man for an emergency project. Meanwhile another lowers the ladder for immediate departure to trouble spot.**

Solving an Industrial Waste Treatment Problem

Successful results have been achieved in the treatment of chemical manufacturing wastes at the Monsanto works at Ruobon, England. A system of acid neutralization, chemical treatment of blended wastes and trickling filters, followed by holding basins for effluent control did not provide a sufficiently high degree of treatment to solve the problem. Accordingly, studies were conducted resulting in additions to the waste treatment system of a Kessener type activated sludge plant for the supplementary treatment of effluent from the trickling filters and a rapid sand filter unit to remove residual suspended solids. The system now gives an over-all 5-day BOD reduction of 99.2 percent, with a final effluent containing only 5 ppm BOD. The receiving stream is now reported to be in excellent condition and completely repopulated with fish and other aquatic life, according to the National Technical Task Committee on Industrial Wastes.

UTILITIES:

WHAT CAN BE DONE ABOUT THEM?

When relocation of utilities is required in advance of paving operations, many costly delays may occur unless responsibility is pinpointed and the work scheduled through cooperative planning.

E. POWELL SMITH,
Utilities Engineer,
Delaware State Highway Department

LIKE TOPSY, the problem of utility relocation "jest grewed." Unfortunately, there has been little corresponding increase in recognition of the problem among those responsible for highway planning. While project engineers, particularly those working in urban areas, are all too aware of the delays and difficulties caused by lack of utility planning, they usually come on the scene too late and at too low a level to do more than make the best of a bad situation. Meanwhile, higher level planning agencies and officials have devoted little more attention to utilities relocation than in the days when it involved no more than calling the power company to relocate a few poles. Frequently, the only reference to utilities in contract specification is some meaningless statement like "Utilities in operation along right-of-way to be relocated by others."

More and more highway mileage is being constructed or reconstructed through built-up areas with a high concentration of utility services. A continuation of haphazard utilities planning can be expected to show up in a greatly increased number of costly delays, with a resultant waste of highway construction funds that at best are never abreast of the nation's mushrooming transportation needs. What's more, the costs may be direct and embarrassing, as in a case recently decided by a Kentucky court. It ruled that a highway contractor who is held up in starting a job by a delay in utilities removal can sue the state for damages. Governmental immunity does not apply, said the court; failure to provide a free and unobstructed right-of-way is a breach of a binding contract.[1]

In Delaware, there is no county road system, and the State Highway Department is responsible for all former county roads as well as certain through routes in incorporated areas. It is also responsible for maintenance of new suburban development streets outside incorporated areas if they are built to Department specifications. Accordingly, a high proportion of the Department's work is already in built-up areas where the utility problem is greatest. Other states are facing a similar situation as urban centers continue to spawn new suburban developments in what were once rural areas.

Responsibility Pinpointed

In April, 1957, the Utilities Division of the Delaware State Highway Department was organized to handle liaison with utilities and to coordinate plans and field problems from program through construction stages. Headed by the state utilities engineer, it is staffed by division utilities coordinators, whose duties and responsibilities are:

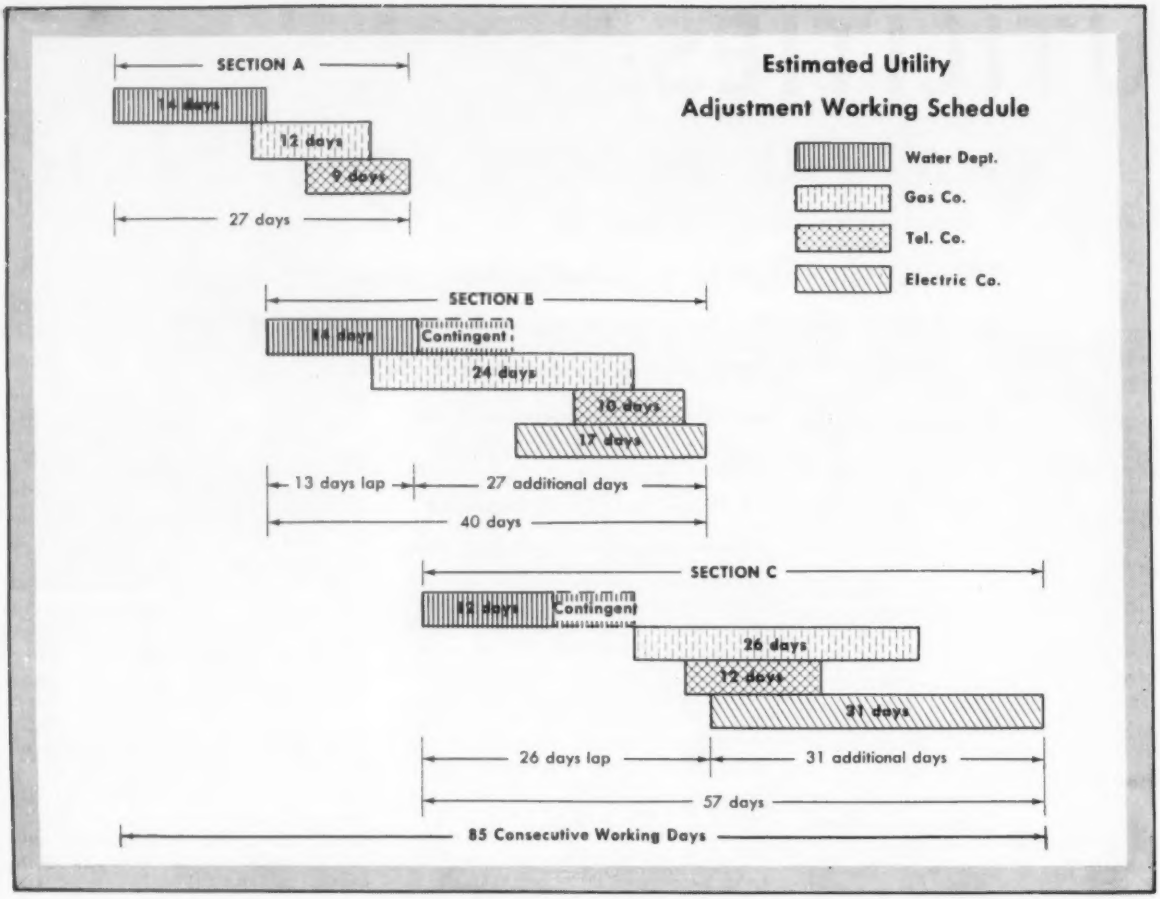
a) Handling liaison between the various Highway Department divisions and the various utility companies.
b) Coordinating the planning, investigation, and prosecution of all utility operations in connection with highway contract work.
c) Developing cooperation between all parties involved in accomplishing required utility adjustments in such a manner that interference with the highway construction program will be minimized.
d) Aiding the various utilities in their planning and scheduling of highway construction needs.
e) Determining and approving the extent, nature and cost of all utility work in connection with highway construction projects which is reimbursable to the utility organizations under State-utility agreement.
f) Developing policies and procedures, with approval of the Chief Engineer, for the proper control and handling of utility operations on State Highways.

This staff position should be filled by a registered professional engineer, with a practical knowledge of all types of public utility operations and facilities. He should have a thorough knowledge of the functional, structural, construction and safety problems peculiar to each utility, and should have a complete understanding of all phases of highway design. He should at all times aim to accomplish his objectives in an equitable and economic manner, but must always be primarily concerned with the expeditious completion of highway projects.

The Division Utilities Coordinator (or Supervisor) represents the Highway Department and assists the Chief Engineer and the State Utilities Engineer with their duties and responsibilities at a division or county level by concentrating on the objectives and required details related to the function of the Utilities Division, including:

a) Making detailed studies jointly with the various utilities to determine what utility adjustments will be required.
b) Enlisting the cooperation of utility organization by keeping them advised of construction progress and by coordinating their activities with those of other groups working on the project.
c) Studying and developing equitable solutions to specific field problems encountered during construction.

[1] "The Construction Week" in Engineering News Record, July 17, 1958.



● SECTION by section schedule of adjustments resulted in complete coordination between all utilities and the contractor.

d) Arranging for conferences with representatives of the department, utility companies and highway contractors for the purpose of exchanging information and discussing problems of utility work, highway construction, and an acceptable plan of field operations.

This position should be filled by an engineer (preferably a registered professional engineer) with a practical knowledge and understanding of all phases of utility work and highway engineering, as well as an ability to promote cooperation among the many organizations involved in a construction project.

Advance planning and coordination and designation of liaison engineers are not, of course, new approaches to the problem. In addition to being self-evident, they have been specifically recommended by the Bureau of Public Roads as means to avoid delays incident to utility adjustments.[2] However, the number of states (about two-thirds of them) reporting frequent or occasional delays due to utilities difficulties indicates that advance planning and liaison have not yet been widely introduced. Where they have been successfully used, it has been largely on a single-project basis where unusual utilities problems were foreseen, rather than as a matter of policy applicable to all construction work.

The Delaware plan is unusual in that permanent responsibility for utility coordination and liaison on all projects has been given to a staff division at the state level, and that the utilities engineer who heads it is required to have a thorough knowledge of each utility's structural, construction and safety problems as well as a complete understanding of highway design.

No sooner was the division organized than it found itself faced with problems along a one-mile city street reconstruction project that was already underway. Although there was no opportunity to do advance planning, the success of the more formalized liaison over the former hit-or-miss (often miss) procedures encouraged the belief that our approach was sound. The utilities quickly became enthusiastic supporters of the new division when they found that they could always find a highway department engineer who understood their problems and was interested in them. Highway Department personnel and contractors were equally pleased to discover how quickly day-to-day difficulties could be ironed out almost as quickly as they arose.

But the real test came just three months after the division started operation. On July 1, 1957, planning was begun on the 4th Street project in Wilmington. This job, involving a main city thoroughfare, included reconstruction of one-half mile of a city street in the heart of the Wilmington business district, and the resurfacing of an additional 1.3 miles of street through a densely

[2]Department of Commerce, Bureau of Public Roads, Circular Memorandum 40-70, "Public Utilities Adjustments," Jan. 3, 1957.

built-up business and residential neighborhood.

Acid Test

Some idea of the utilities problems on the job can be grasped from the fact that initial talks with the power company revealed high voltage cables in conduit were located only 15 inches below the pavement surface, and that gas and water lines were found within 9 inches of the pavement—they had originally been laid over, rather than through, subterranean rock.

Preliminary plans were received from the consulting engineers, Whitman, Requardt and Associates of Baltimore, in October, and were immediately sent to all utilities with a request that they plot their existing lines. This provided the Highway Department with an adequate picture of what might be expected during construction, and gave the utilities an opportunity to begin plans for any renewal or reconstruction of their facilities they might wish to undertake. The project embraced five different utilities furnished by four agencies. They were the gas and electric services of Delaware Power and Light Company, telephone service of Diamond State Telephone Company, water service of the Wilmington Water Department, and sewers under jurisdiction of the Wilmington Street and Sewer Department.

As soon as semi-final plans were available, on February 4, 1958, they were sent to the utilities so they could indicate on them the scope of the utilities work they planned. The utilities cooperated to the fullest extent possible, returning the plans within days. By February 26, the Highway Department had final plans and was able to advertise for bids.

Following the procedure that is now routine on all contracts, a Utilities Coordinating Committee was organized, with representatives of each utility and of the Utilities Division and the County Division of the State Highway Department. Since the contract had not yet been awarded, a representative of the Associated General Contractors of Delaware was invited to attend the pre-award meetings to reflect the contractor's viewpoint. After the award, he was replaced by a representative of the successful bidder.

The first meeting of the committee was held on March 6, with the representative from each utility reviewing in detail the work they proposed to do, the number of crews available to do it, and the estimated time that would be required for it.

It was evident at once that the utilities problem would be even greater than expected. The estimated times were as follows: Telephone, 3 months; electric, 4½ months; gas, 4 months; and water, 4 months.

Work To Be Done

Here is the work each utility planned to do in the half-mile area to be reconstructed:

Water—Replace 305 ft. of 4, 6 & 8-in. main; renew 76 services @ 12 ft. each; renew 73 services @ 52 ft. each; relocate 10 hydrants; install 10 new hydrants; adjust and repair 59 main valves; and install 11 new valves.

Gas—Renew 2175 ft. of longitudinal mains, mostly 8-inch; renew 550 ft. of transverse mains at intersections; renew 69 services @ 25 ft. each; renew 69 services @ 20 ft. each; and overhaul and repack joints on 2185 ft. of existing mains.

(*Continued on page* 208)

● **BEFORE: This is how W. Fourth St. looked before the improvement began. This section was a part of the 1.3-mile project of resurfacing described in this article.**

● **AFTER: Another portion of W. Fourth St. showing the difference in pavement surface and the new lighting. Coordination of utility work was important factor.**

Versatile Equipment

Sparks County Highway Operation

FEW COUNTY highway departments are charged with the responsibility of handling all county road construction as well as maintenance. However, that this type of inclusive operation can pay off, if handled efficiently, is shown by the operation's of the Winnebago Co., Ill., Highway Department.

With headquarters in Rockford, the department consists of 40 men, most of whom are construction equipment operators. They have built and maintained all 300 miles of county highways. According to H. Bernard Brown, Field Superintendent, a primary factor in managing an operation of this size is judicious use of equipment. Every piece of construction equipment must provide maximum versatility. As an example, a front-end wheel loader is being used for a variety of material handling jobs in the material yard, as well as in construction operations. This, a TL-20D tractor loader, is a 4-wheel drive tractor equipped with a 2-cubic yard bucket. During the winter months, this loader is a vital unit in snow removal operations. During heavy storms, trucks must be loaded quickly with crushed stone and dispatched to critical areas. When the snowfall is light, the trucks are quickly loaded with salt or cinders. For these jobs the front-end loader is an essential piece of equipment.

The loader can fill an 8-yard truck in a little over 2 minutes. Rapid loading is due not only to bucket size, but largely to maneuverability. The wheel-loader is equipped with a power shift transmission with a single lever controlling all speeds in both directions—forward and reverse. A torque converter provides smooth operation.

Stockpiles in the material yard are maintained by the TractoLoader and it is also used for loading pipe. In cleaning drainage ditch areas close to culverts, the TractoLoader is most economical. Operating from the road, its bucket can be lowered close to the culvert to clean out loose earth, weeds and other obstructions. The tip-back bucket follows the contours of the ditch without altering ditch contours.

In the spring the loader is used along highways to dig out frost boils on black top. It's a simple matter to remove asphalt paving with the pry-out action of the bucket.

● **LIFT and reach of TractoLoader speeds truck loading. Experience in Winnebago County shows that an 8-yd. truck can be loaded in only a little more than 2 minutes.**

● **MISCELLANEOUS operations such as stacking drainage pipe in the materials yard are facilitated by the TractoLoader's maneuverability. Unit has rear wheel steering.**

● STUDY OF refuse problem resulted in reducing manpower from 62 to 36 and packer trucks from 14 smaller to 9 larger units.

EFFICIENCY STUDY

Cuts Refuse Handling Costs

FRANK R. SMILEY,

Assistant Village Manager,

Oak Park, Illinois

A REDUCTION in refuse collection and disposal costs of 30 percent, or $125,000 per year, is the dividend being realized in Oak Park, Ill., from six months of intensive self-analysis. A few informal proposals were obtained in 1958 from competent contractors in the Chicago area, and their prices were stacked up against Oak Park's costs for continuing to collect and dispose of refuse with its own forces and equipment. The comparison was unfavorable, but the policy makers and the administrative staff were reluctant to delegate to a contractor this extremely sensitive area of public service. It was decided to undertake a six months campaign of reorganization. By January, 1959, the job would either be at a satisfactory cost level or contractors would be asked for formal bids.

Under the direction and coordination of the Village Manager, Mark E. Keane, a carefully developed plan of analysis was put into operation, directed principally at 1) leadership and supervision; 2) a shift from a system of separate collection of combustible and non-combustible refuse; and 3) better disposal facilities.

The principal problem was recognized as the inefficiency resulting from separate collection of combustibles and non-combustibles. Garbage and other combustible refuse were burned in the Village's antiquated 1929 model incinerator; non-combustibles were collected separately and hauled to a leased dump site approximately ten miles away. More than half of the fourteen packer trucks in service were of less than sixteen cubic yard capacity since they had been used for making short hauls to the centrally located incinerator.

To get a fresh and objective analysis of the entire operation, it was decided to bring in on a part time basis Harry Bell, a ward superintendent with the Chicago Bureau of Sanitation. A series of tests to compute loading times and travel times was started. Other studies were made on the compaction effectiveness of the Village trucks. Record systems were improved, and each driver was supplied with a daily report sheet with instructions to keep it current, checking off each pre-numbered block as it was completed during the day.

Manufacturers of the various types of packer bodies were invited to supply demonstrators for a one week operation, with five different units tried in test areas on combined collection. For a two-week period a test was made using one of the private scavenger firms, assigned to a small section of the village which had been selected as a combined collection test area.

Some of the more obvious operational problems included the complete lack of stand-by equipment, no specifically designated route for the 20-mile round trip to the dump, and the lost time involved as the two helpers went along for the ride on the one hour to one and a half hour round trip to the dump.

Men were shifted to work which they could do best; older employees were assigned to less strenuous tasks where possible; and open truck collections were reduced to two units. The men responded well to the superintendent's belief that most men will do a day's work if the work is there to be done and if they are properly instructed.

Disposal

In an effort to reduce the expense of the long haul to the disposal site, we investigated the possibilities of establishing a transfer station. Specifications were prepared and bids were received from several contractors interested in contract hauling. However, the bids seemed too high to justify even a trial program of this type.

A satisfactory disposal facility may become the key to the entire

refuse problem, and our situation was no different. Two things appeared certain: The incinerator would have to be closed and our open dump would not be acceptable for a combined collection. Incinerator operators and dump owners were contacted, and we soon learned that a suitable disposal facility in the Chicago metropolitan area is a rare and coveted asset.

In the middle of our investigations, we were notified that the operation of our leased dump was changing hands and that it would become a sanitary land fill. Equipment which we could never have afforded transformed our old open dump into a genuine sanitary land fill, complete with roads, heavy equipment and responsible operators. Our new agreement with the land fill operator provides for several years' dumping at a fair price and protection for the Village if we rebuild our incinerator before the expiration of the dump agreement.

Studies are under way to determine the feasibility of rebuilding the now abandoned incinerator. It is structurally sound and possibly adaptable to modern incineration equipment.

Same Service—Less Cost

With the disposal problem solved and an accurate estimate of what could be done with a minimum of equipment, a date was set for the beginning of a combined collection system; appropriate news releases were issued; and new equipment was ordered. The total changes and improvements that had been made by 1959 were impressive:

Manpower in the refuse collection service had been reduced from 62 men to 36. Equipment had been similarly cut back, reduced from 14 packers and 6 dump trucks to 9 packers and 3 dump trucks, with two of the old packers used as stand-by equipment. The incinerator had been closed. Over 700 of the 1400 concrete shovel boxes in the alleys had been destroyed, with the written consent of the owners. Two of the four new 20-yard packers had been received and put into operation. An additional inspector had been added to the street division to assist in public relations and to step up the container enforcement program.

The level of service had remained as high as ever. In fact, alleys were noticeably neater and schedules were easier to maintain with spare trucks available in case of breakdowns. Primarily as a result of these savings in refuse costs, the total overall Village budget for 1959 showed total estimated expenditures to be $118,000 less than for 1958. Reduced expenditures in refuse collection and disposal alone saved more than that—a whopping $125,000.

● **ONE OF THE new 20-yard trucks is being checked by Joe Mack, Street Superintendent, while Ass't. Sup't. Ralph Thomas, at rear, checks loading and packing action.**

Future Plans

Needless to say, the Village Manager and his staff had delivered the goods, and the elected officials are satisfied with what has been done so far. The next step is perhaps as clear now as the first was last year. Instead of having our refuse trucks make a 20-mile round trip haul to a dump site in addition to paying $30,000 to $40,000 a year in dumping fees, we should operate our own modern incinerator.

Preliminary drawings have already been received and informal estimates have been made. Indications are that Oak Park can convert its old plant into an efficient incinerator for $500,000 or less. If we realize half the luck, enthusiasm, cooperation and leadership on this project that we had in 1958, we cannot miss.

● **CONVERSION of old incinerator into a modern 300-ton per day plant is discussed by Mr. Mack, Mr. Thomas and Frank Smiley, the assistant to the City Manager.**

What are the CHARACTERISTICS of the UNKNOWN PUMP?

A method of approximating performance characteristics and determining power requirements and safe operating pressures by an analysis of the physical measurements of a centrifugal pump.

IGOR J. KARASSIK,*
Consulting Engineer and Manager of Planning, Worthington Corporation

GENERALLY, when a centrifugal pump user wishes to determine the performance characteristics of a given pump in his possession, he has a large reservoir of information from which these data can be determined:

a) He will probably have a file copy of the order on which the pump was purchased.

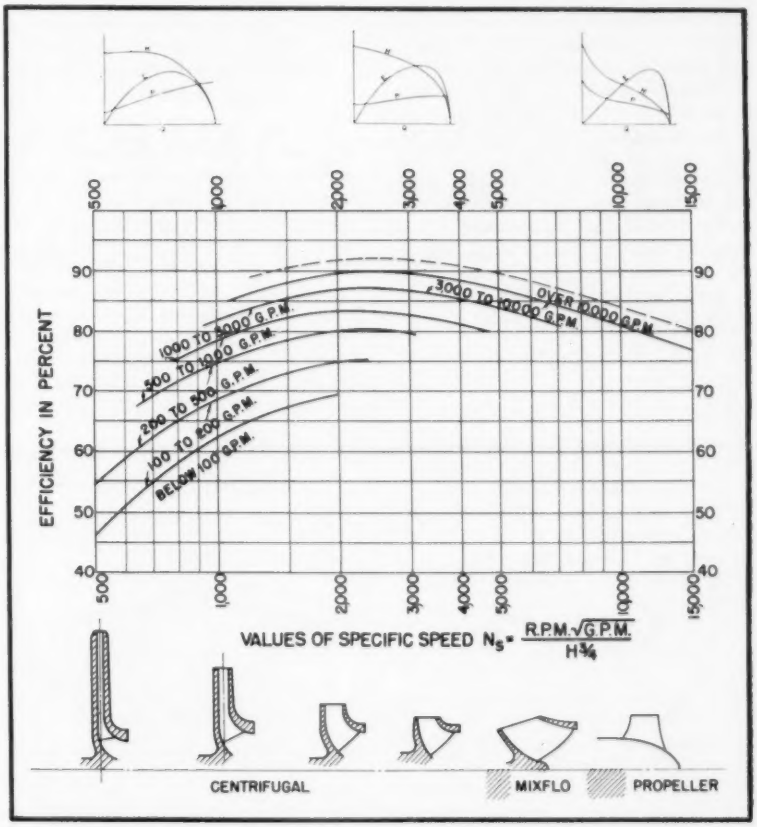
b) In addition, or instead, he may consult the nameplate of the pump. This nameplate generally carries the pump shop serial number, the manufacturer's type designation and the rated conditions of service, including the operating speed.

c) This speed is also listed on the pump driver nameplate or, should this nameplate be missing, from a direct speed measurement on this driver.

If the pump make and serial number are known, it is a simple matter to get the desired information from the manufacturer. If the make but not the serial or other identifying number or letter is known, most manufacturers can identify the pump type and impeller design, if given 1) the nozzle sizes; 2) a sketch showing the external appearance and dimensions of the pump; and 3) the major impeller dimensions.

It is therefore seldom that a pump is available but both pump and driver nameplates have disappeared, no record of the purchase is available and the only thing certain is the physical presence of the pump itself. Nevertheless, it is still possible to carry out certain measurements and calculations to obtain the desired information with some degree of accuracy.

There are two separate phases to the problem of estimating the performance of a centrifugal pump of which one knows nothing except the physical dimensions and proportions. The first phase is the theoretical aspect of the problem which would give us a reasonable approximation of the pump Head-Capacity curve at any given operating speed and the expected power consumption of the pump. The second phase of the problem concerns the practical aspects of the applica-



● **FIGURE 1. Typical single suction impeller outlines and their related specific speeds, which remain constant for all geometrically similar pump designs. Above the graph showing efficiencies are curves that illustrate approximate characteristics.**

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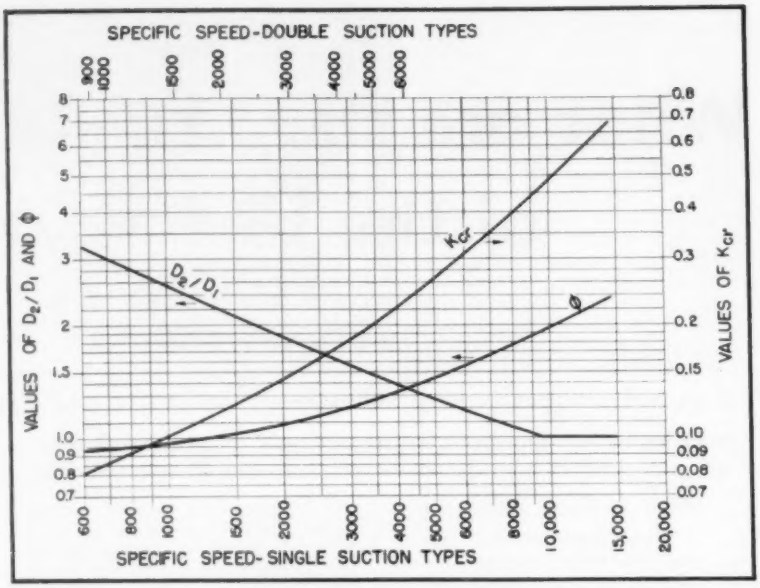
tion of the pump to a particular service. Is the physical design of the pump suitable for the power and the speed selected? Is the casing design suitable for the operating pressure? Will the pump operate satisfactorily under the suction conditions contemplated?

Specific Speed

Many of the advances made in the field of centrifugal pump design can be credited to the development and application of the principle of model and prototype relationship in hydraulics. This principle has enabled pump designers to predict the performance of centrifugal pumps on the basis of the behavior of other pumps, smaller or larger in size, operating over a wide range of design conditions, but modelled from and geometrically similar to each other. The concept of "Specific Speed" was introduced to combine the three separate factors of performance characteristics (that is, capacity, head and speed) into a single term such that two pumps geometrically similar to each other have the same specific speed. This concept, therefore, is an extremely useful parameter for correlating the performance characteristics of various types of centrifugal pumps.

Thus, the specific speed of a pump is an *index* of its type, as long as it is determined with reference to the best efficiency point on the pump characteristic curve. We need not present here the mathematical analysis used to establish the relationship between the specific speed and the operating characteristics of a centrifugal pump. This analysis yields the following relation:

$$N_s = \frac{n\sqrt{Q}}{H^{\frac{3}{4}}} \quad \ldots\ldots\ldots (1)$$



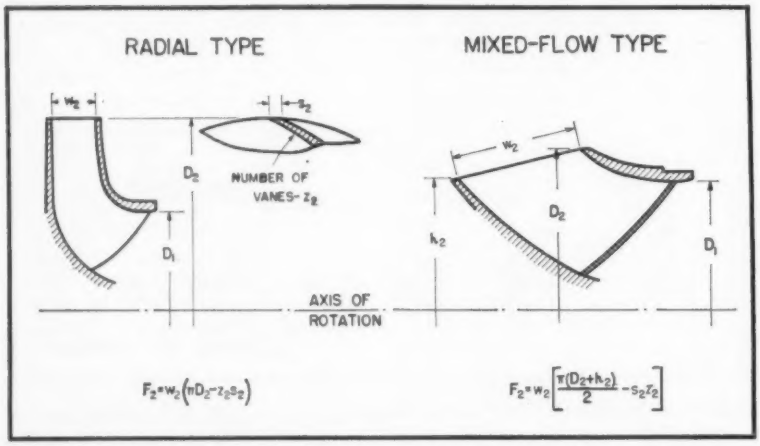
● **FIGURE 3. Variation of D_2/D_1 ratio and constants ϕ and K_{cr} with specific speed.**

where

N_s = Type specific speed
n = Pump speed in revolutions per minute
Q = Capacity at best efficiency in U.S. gallons per minute
H = Head per stage at best efficiency, in feet

For any given impeller, the specific speed does not change with the operating speed, since any change in speed carries with it a change in capacity in direct proportion to the speed and a change in head varying with the square of the speed.

A double suction pump impeller may be considered as two single suction impellers, each of half the width of the double suction impeller and, hence, each handling half the capacity of the latter. On the other hand, the formula for specific speeds remains unchanged regardless of whether a single or a double suction impeller is involved. It is customary, therefore, when listing a definite specific speed, to mention which of the two types of impellers is in question.



● **FIGURE 2. Dimensional symbols for impellers and formulas for the area F_2.**

Uses of the Specific Speed Concept

One of the most important applications of the specific speed concept is the fact that all sizes of pumps can be indexed by their type specific speed. Thus, for geometrically similar designs, the performance of any impeller of the series can be predicted from the knowledge of the performance of any other impeller of the series. Because the physical characteristics and the general outline of impeller profiles are intimately connected to their type specific speeds, the value of the latter can immediately evoke in the mind of the designer the approximate impeller shape in question. As an illustration of this statement, Fig. 1 shows a few typical single suction impeller outlines tied down to their specific speeds.

The specific speed of a given pump will also reflect very definitely in the shape of the pump characteristic curves. While some variations in the shape of these curves can be obtained by changes in the design of the impeller and casing waterways, the variations which can be obtained without adversely affecting the pump efficiency are relatively small. Approximate

characteristics for the impeller types shown on Fig. 1 are illustrated over their specific speeds.

Approximate Specific Speed Type From Impeller Outline

Prior to the general use of specific speed as a type index, the ratio between the impeller outside diameter (D_2) and the suction eye diameter (D_1) was frequently used for that purpose. (See Fig. 2 for symbols of impeller dimensions used in this article). An approximate relation between the D_2/D_1 ratio and the specific speed of single suction impellers is shown on Fig. 3. A double-suction impeller will have a type characteristic approximating that of a single-suction impeller having a specific speed of 70.7 percent (that is $1/\sqrt{2}$) of that of the double-suction impeller.

It should be noted that this method of identifying the specific speed from the D_2/D_1 ratio fails for axial flow impellers which fall in a 9000 to 20,000 specific speed range. Their output and hence their specific speed depends on the angle and length of the vanes as well as the number of vanes. To predict the characteristics of axial flow impellers, one would require very detailed information on the impeller and other pump parts. As a result, no simplified guide can be offered for general use for this type of pump.

Head and Capacity Constants

There are two design constants which can be used in approximating the performance of a centrifugal pump. One expresses the relation between the impeller peripheral speed and the total head. The second relates the radial discharge velocity from the impeller (and hence, the capacity) and the total head. The formulas for these constants are:

$$\varphi = \frac{u_2}{\sqrt{2gH}} \quad \text{.....(2)}$$

and

$$Kcr = \frac{c_2}{\sqrt{2gH}} \quad \text{.....(3)}$$

where:

u_2 = Peripheral velocity in feet per second

c_2 = Radial discharge velocity in feet per second

H = Total head (per stage) in feet

Let us then convert these relations in terms of impeller dimensions which we can measure.

u_2 = Dia. in ft. x Rev./sec. x 3.1416

$$c_2 = \frac{\text{Capacity in cu. ft./sec.}}{\text{Area in sq. ft.}}$$

If

D_2 = Outside dia. of impeller in ins.

F_2 = Discharge area of impeller in square inches (See Fig. 2)

Then:

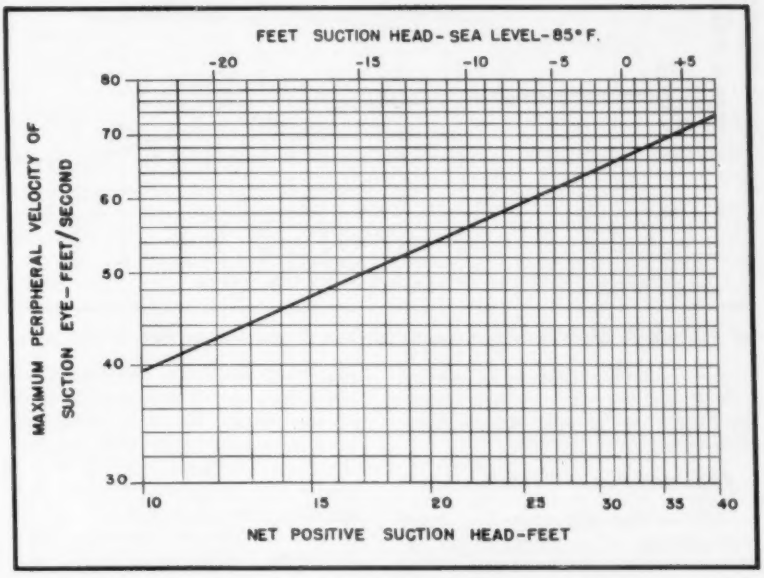
$$u_2 = \frac{D_2 \times n \times 3.1416}{12 \times 60} = \frac{D_2 \times n}{229} \quad \text{.....(4)}$$

$$H = \left(\frac{D_2\, n}{1840\, \varphi}\right) \quad \text{.....(2b)}$$

and

$$Q = 25\, Kcr\, F_2 \sqrt{H} \quad \text{.....(3b)}$$

Both φ and K_{cr} vary with the specific speed type and, to some extent, with the individual impeller and casing design. The relation between φ and N_s and between K_{cr} and N_s representative of a normal design of pumps is shown on Fig. 3. As in the case of the D_2/D_1 vs N_s curve, these curves show average



● **FIGURE 4. Approximate limit for peripheral velocity at suction eye vs NPSH.**

and

$$c_2 = \frac{Q \times 144}{7.48 \times 60 \times F_2} = \frac{Q}{3.117\, F_2} \quad \text{.....(5)}$$

We can now replace equations (2) and (3) by

$$\varphi = \frac{D_2 \times n}{229\sqrt{2gH}} = \frac{D_2 \times n}{1840\sqrt{H}} \quad \text{.....(2a)}$$

and

$$Kcr = \frac{Q}{3.117\, F_2 \sqrt{2gH}} = \frac{Q}{25\, F_2 \sqrt{H}} \quad \text{.....(3a)}$$

We can further transform these equations to give us head and capacity values directly:

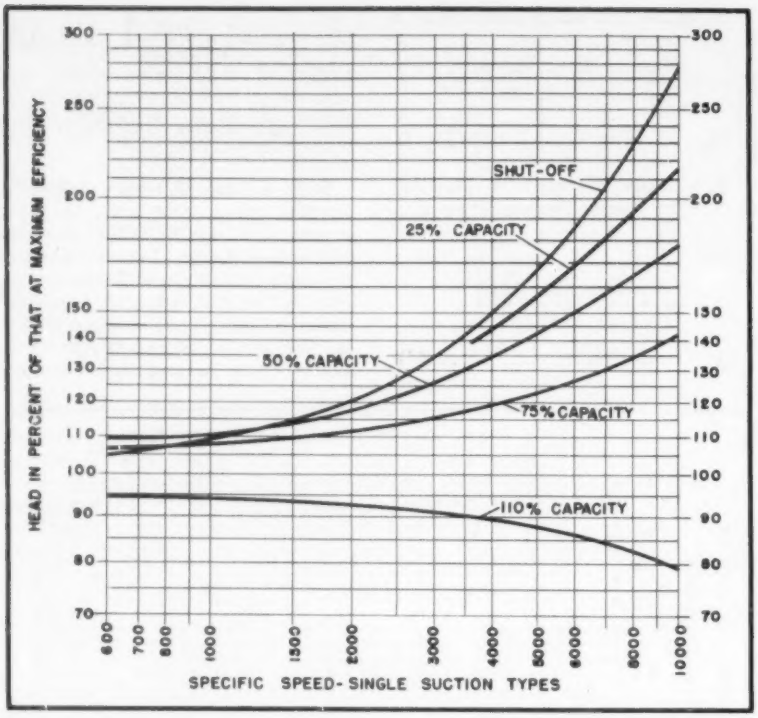
values and the actual values for an individual design can be expected to vary somewhat from the values shown on Fig. 3.

Maximum Speed Limitation

Present day practice in the U.S. places a limit on pump speed by limiting the maximum specific speed type for any combination of total head and suction conditions. Before the widespread use of the specific speed concept, the maximum rotative speed of an impeller was often determined by limiting the peripheral velocity of its suction eye (D_1) to a certain value, depending on the suction conditions. This velocity can be established exactly as in the case of the peripheral velocity of the outside impeller diameter in Equation (4). Thus:

Suction eye velocity =

$$\frac{D_1 \times n}{229} \quad \text{.....(6)}$$



● **FIGURE 5. Chart showing normal variations in head values with specific speed.**

A reasonable maximum peripheral velocity for the suction eye is shown on Fig. 4 for various suction conditions.

Expected Power Consumption

Determining the possible head and capacity of a pump would be of little value in applying this pump, if the power required to drive it could not be predicted. Fig. 1 shows the approximate maximum efficiency for both single- and double-suction pumps that can be obtained with present day designs. How close an existing pump would approach these values would depend on the individual pump. Expecting anything between 80 and 100 percent of the efficiencies shown on Fig. 1 might be reasonable if the pump is not over 30 years old and of the single stage type. Multistage pumps, with abrupt cross-over passages from one stage to the next should be expected to be less efficient by two to three points of efficiency.

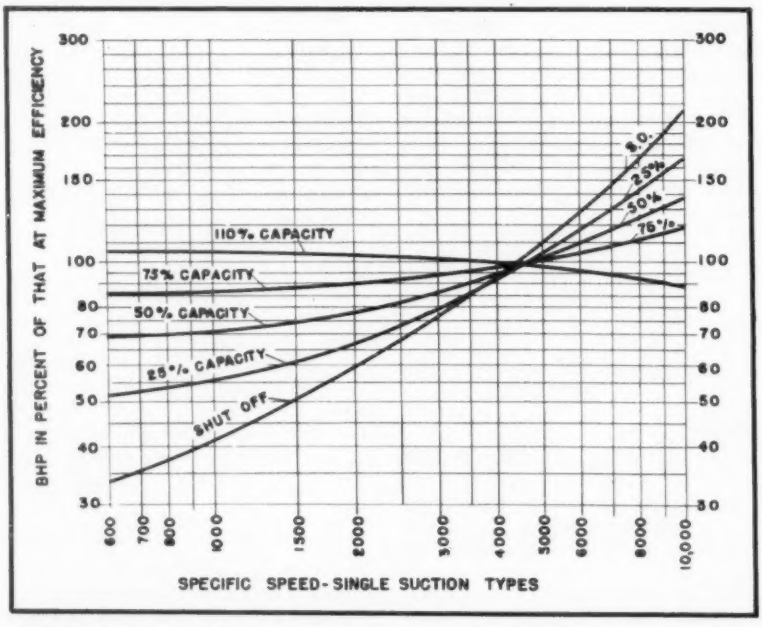
Shape of Head-Capacity and Power-Capacity Curves

Once the head, capacity and power consumption of a pump at a given speed have been established for the best efficiency point, it remains to approximate the curves relating the head and power to the capacity over the entire pump operating range. We have already seen that the shape of these curves is affected by the type specific speed of the pump. Three curves have been prepared to permit the construction of these curves. Fig. 5 shows the variation of head with specific speed for shut-off, 25, 50, 75 and 110 percent capacity. Fig. 6 shows the variation of power with specific speed for the same capacities. Fig. 7 shows the effect of specific speed on the efficiency at 25, 50, 75 and 110 percent of rated capacity. The values shown on Figs. 5, 6 and 7 represent more or less normal impeller-casing designs and combinations.

The variation in the shape of the characteristics between a single-suction impeller with shaft through the eye and an overhung single-suction impeller is negligible. Thus, data from Figs. 5 to 7 can be applied to either type. We have already stated that a double-suction impeller will have a type characteristic approximating that of a single-suction impeller having a specific speed 70.7 percent of that of the double-suction impeller.

Safe Power Input

The shaft of a centrifugal pump is subject to both bending and torsional stresses. Usually, its smallest diameter is at the coupling and this section is subjected primarily to torsional stress only. Generally, centrifugal pump shafts are designed not to exceed a torsional stress at the coupling of 7,000 pounds per square inch for safe maximum continuous loading. Therefore, in predicting pump performance, one should check to see if the maximum expected power at the selected speed keeps the torsional stress within the recommended 7,000 psi limit. If not, the pump is not mechanically safe for operation at the selected speed. The



● **FIGURE 6. Variation of power values and specific speed for selected capacities.**

relation between transmitted HP, speed, shaft diameter and permissible torsional stress is given by the well-known relation

$$HP = \frac{S \times n \times d^3}{321{,}000} \quad \ldots\ldots(7)$$

where

S = Permissible stress in psi
d = Shaft diameter at coupling in inches

Safe Operating Pressure

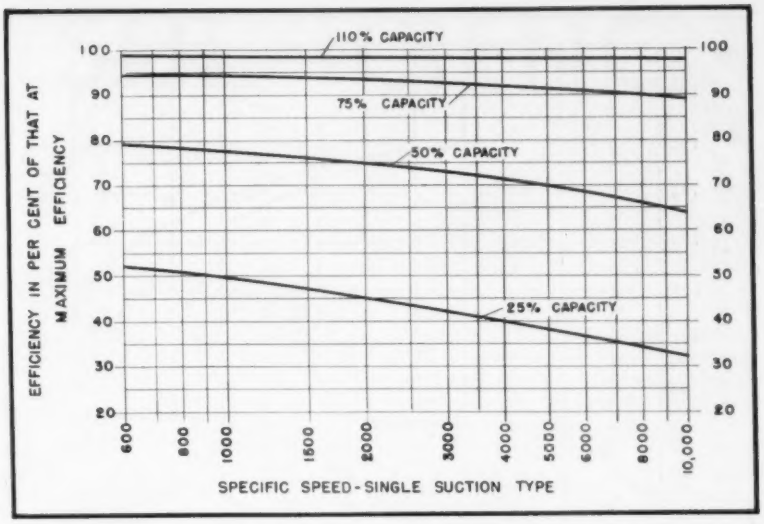
To determine the safe operating pressure of a given pump would require a very detailed study. Some idea of a possible maximum can be obtained by examining the size and drilling of the discharge nozzle flange. This is somewhat of an indefinite limit, especially in the U.S. where the so-called 125 flange which is good up to 175 psi hydraulic operating pressure is generally used for all pressures below that value. Many pump designs using such flanges are not good for operating pressures that high.

A more satisfactory check of safe operating pressures is the bolting of the casing or casing heads. In actual design studies, maximum safe bolt stresses are calculated with full knowledge of the areas subjected to internal pressures, of the maximum expected hydraulic pressure and of the forces required to compress joint gaskets. A good approximation can be obtained by limiting the bolting stress at the root of the threads to 5,000 psi. Thus:

Safe working pressure in psi = $\frac{5{,}000 \times A_r \times \text{Number of bolts}}{\text{Area subjected to hydraulic pressure in sq.inches}}$ ..... (8)

where

A_r = Root area of bolt in sq. inches



● **FIGURE 7. Relationship between efficiency values and specific speed types.**

Applying the Methods to a Typical Pump

Let us assume that we are analyzing a modern double-suction, single stage centrifugal pump with an 8″ discharge and 10″ suction, both having 125 pound flanges. Various relevant dimensions are given below:

Impeller

$D_2 = 12\frac{1}{4}''$
$D_1 = 6\frac{1}{8}''$
$w_2 = 2\ 1/16''$
$z_2 = 7$
$s_2 = \frac{3}{8}''$

The shaft diameter is 1-9/16″ at the coupling, increasing to a maximum at the impeller. The area of the horizontal split is 200 sq. inches. The pump casing is held together by 21 ¾″ studs and bolts. The intended drive is a 60 cycle induction motor.

$$D_2/D_1 = 12.25/6.125 = 2.0$$

Referring to Fig. 3, a D_2/D_1 ratio of 2.0 indicates an impeller type with specific speed $N_s = 1{,}700$ if single-suction or $N_s = 2{,}400$ if double-suction. The head and capacity constants are:

$\varphi = 1.06$
$K_{cr} = 0.13$

Assuming that the pump will be applied to an installation involving 15 feet suction lift at sea level, handling cold water, the NPSH (net positive suction head) will be, roughly, 17 feet. From Fig. 4, we can establish that the maximum safe peripheral velocity at the impeller suction eye is about 50 feet per second. Solving for the rotative speed in equation (6), we get:

$$n = \frac{50 \times 229}{6.125} = 1860 \text{ RPM.}$$

Therefore, 1750 RPM will be the maximum possible rotative speed with a 60 cycle motor.

Using equation (2b), we can calculate the pump head at 1750 RPM:

$$H = \left(\frac{12.25 \times 1750}{1840 \times 1.06}\right)^2 = 120.5 \text{ feet}$$

Using the formula on Fig. 2, we can calculate F_2, the discharge area of the impeller:

$F_2 = 2.0625\ (3.1416 \times 12.25 - 7 \times 0.375)$
$= 74.2$ sq. inches

Now, we are ready to use Equation (3b) to estimate the pump capacity:

$$Q = 25 \times 0.13 \times 74.2 \times \sqrt{120.5} = 2650 \text{ GPM}$$

We can therefore expect that, when operated at 1750 RPM, this pump will deliver 2650 GPM against a total head of 120.5 feet at its best efficiency point. We can recalculate its specific speed, N_s, from equation (1):

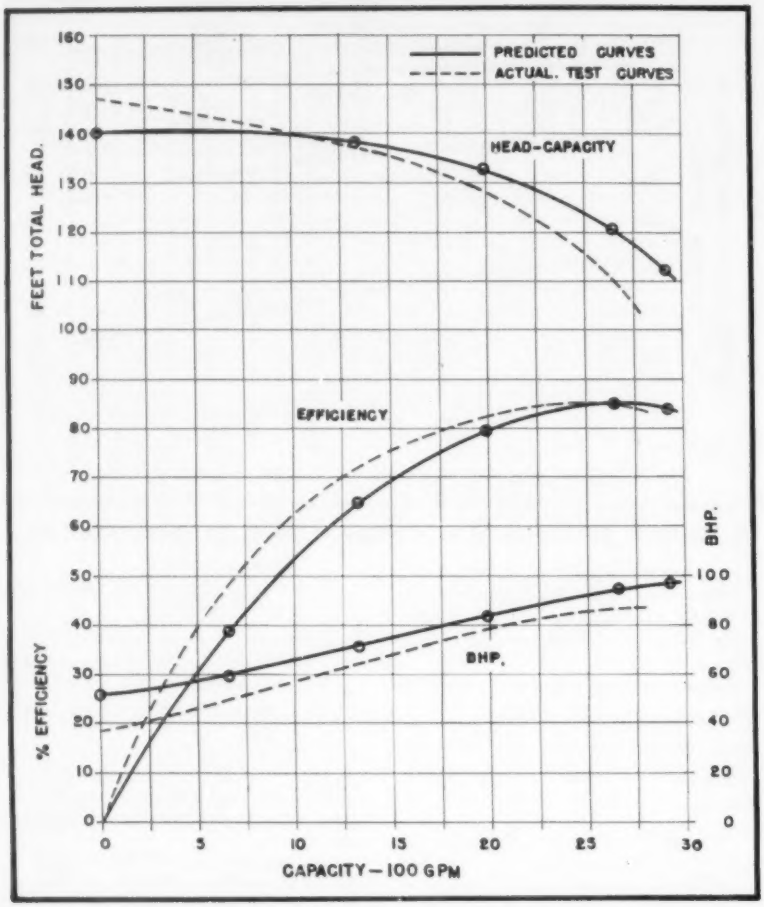
$$N_s = \frac{1750\sqrt{2650}}{(120.5)^{\frac{3}{4}}} = 2480, \text{ double suction.}$$

From Fig. 1, we would expect that, for this specific speed and capacity, the maximum efficiency would be somewhat above 85 percent. If we were to use 85 percent, the power consumption would be

$$HP = \frac{2650 \times 120.5}{3960 \times 0.85} = 95$$

Working from these values of capacity, head, efficiency and horsepower and using the percentages shown on Figs. 5, 6 and 7 (for a single-suction N_s of 2480 x 0.707 = 1743) we can obtain the points listed in Table 1 (next page).

Plotting these points, we obtain the approximate curve shown on



● **FIGURE 8. Comparison of the pump characteristics predicted from impeller dimensions and the actual characteristics determined by test shows close agreement.**

Table 1—Approximate Points on Capacity, Head, Efficiency and Horsepower Curves

Capacity in		*Head in*		*Power*		*Efficiency*	
%	*GPM*	*%*	*Feet*	*%*	*BHP*	*% Max.*	*Actual*
0	0	116.5	140	54	51.2	0	0
25	662			62.5	59.4	45.7	38.8
50	1325	115	138	75	71.2	75.6	64.3
75	1987	110	132.5	88	83.6	93.8	79.6
100	2650	100	120.5	100	95	100	85
110	2915	93	112	103	97.8	99	84

Fig. 8. The actual test curve of the pump has been superimposed on the same graph for comparison.

Using equation (7) we can determine whether the pump shaft is suitable for this application:

$$\text{Safe HP} = \frac{7000 \times 1750 \times 1.562^3}{321{,}000} = 145$$

The shaft is obviously safe for 1750 RPM operation.

It remains to check the pump for the safe operating pressure. The ¾" bolts and studs holding the two halves of the casing together have an area of 0.302 sq. inches at the root of the threads. Applying equation (8), we get:

$$\text{Safe working pressure} = \frac{5000 \times 0.302 \times 21}{200} = 158.5 \text{ psi}$$

This is about 2.6 times the expected shut-off head of 140/2.31 or 60.5 psi, when operating at 1750 RPM. It appears that the casing will be amply strong for the intended operation.

Conclusion

The foregoing example has demonstrated that it is possible to approximate the performance of centrifugal pumps other than those of the axial flow impeller type. Nevertheless, this should be resorted to only in the absence of a more reliable method and certainly should be used with caution.

● ● ●

Master Plan and Report For Ultimate Drainage Facilities

The basic criteria for the master plan of drainage facilities of Los Angeles, Calif., has been fixed as the determination of the ultimate storm water runoff which may be expected on the basis of a 10-year frequency of occurrence within each drainage basin. The computation of this data is being facilitated by the use of the new electronic computer acquired by the City, using computer programs which have been developed within the Division.

Ultimately, the material so developed will be recorded on two types of maps and a set of tentative profiles which will cover every section of the City.

Map A will contain information pertaining to drainage basin boundaries, areas, soil and zoning classifications, and the computed surface runoff quantities at selected existing and contemplated street intersections. It is anticipated that this map will be kept up to date, showing the effect of annexation, zoning changes, and actual storm drain construction.

On Map B will be delineated the existing storm drains, those additional ultimately required storm drains included in the master plan and the residual surface runoff quantities anticipated at the same existing and contemplated intersections shown on Map A. The proposed additional drains will be designated by index numbers, and tentative profiles of each such drain will be prepared on which the tentative type, size and depth will be indicated. This material will be invaluable in assisting in determining the proper location and depth of future utility substructures, such as the larger-sized water, gas and fuel pipe lines.

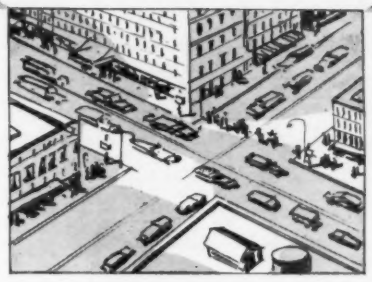
At the end of the 1957-1958 fiscal year, 42 square miles, or approximately 10 percent of the City, had been tabulated, the runoff quantities computed, and Maps A and B covering this area started.

The above data are reported by the Los Angeles Department of Public Works.

STREET SUFFICIENCY STUDY

CHARLES E. JOERS,

**Road Life Study Engineer,
Dept. of Public Works,
Milwaukee, Wisconsin**



IN 1955, the City of Milwaukee recognized the need of analyzing its street system on the basis of functional adequacy as well as structural adequacy, and after extensive research and many trial studies developed a sufficiency study. Such a sufficiency study is a means of comparing segments of a street system by reducing their physical characteristics to a numerical value. This system allows us to rate objectively any portion of our street system with respect to any other portion on a mathematical engineering basis without being clouded by the personal prejudices of the rater.

This development was completed in 1956 and we subsequently rated all the streets in the city which carry over 5000 vehicles per day; this comprises some 250 miles of our approximately 1200 mile street system. The traffic volume on these streets range from 5000 VPD to in excess of 45,000 VPD with an ADT of 12,500 on the system rated.

The system is based on 100 points for a "perfect" street, and is broken down into two main elements: Structural adequacy and functional adequacy. These are further broken down into five main factors: Observed condition, life economy, ridability, traffic capacity and safety.

A new street, constructed to modern design standards would receive the maximum number of points allotted to each of the factors shown in Chart I. As the need for improvement on a section of street increases, the number of points given to the various factors will decrease. The effect of this method is to give those sections of street least in need of corrective treatment a higher rating than those in need of much corrective treatment. The section of street with the lowest number of points will be the one most in need of corrective treatment and will receive first priority.

Structural adequacy is the condition of the street from a physical standpoint, as determined from a field inspection of actual physical condition, the life economy (expectancy) as determined by field inspections and mortality survivor curves, and the quality of the ride.

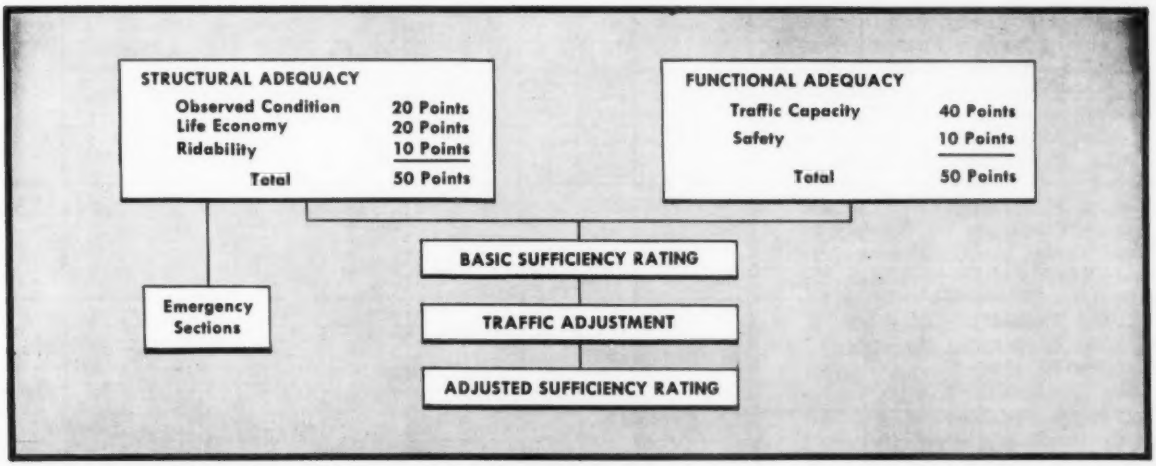
Function adequacy is a measure of the streets ability to handle traffic, and a measure of the safety it affords the motorist using the street.

The sum of the ratings given to each of the two main basic elements is the basic sufficiency rating for a section of street. We then adjust this basic rating according to the traffic volume on the street, as will be shown later. The adjusted sufficiency rating is the rating which will be used for comparing the sections of streets under consideration.

In any survey certain sections of a street will be in such poor condition that they will require some sort of immediate remedial treatment regardless of their rating on the functional element. These sections are classed as emergency projects and should be selected on the basis of their low structural adequacy rating.

The actual rating of a street is a combination of field observation and office compilation. To gather the data we use the following forms:

Form RL-2, Observed Condition



● **CHART I: Rating system considers structural adequacy of highway as well as the traffic capacity and safety factors.**

PERCENT DEFECTIVE	DEF. CURB	CONCRETE						BITUMINOUS						BRICK OR STONE				TRACK ZONE				
		Scaling	Cracking	Faulting	Disintegration	Holes		Complete Failure	Holes	Cracking	Corrugating	Worn		Holes	Irregular Surface	Wavy		Wrong Grade	Holes	Cracking	Faulting	
0 - 20	1	2	1	3	4	2		4	3	0	3	0		4	0	3		0	2	0	0	
20 - 40	2	4	2	6	8	4		8	6	2	6	2		8	2	6		2	4	1	2	
40 - 60	3	6	3	9	12	6		12	9	4	9	4		12	4	9		4	6	2	4	
60 - 80	4	8	4	12	16	8		16	12	6	12	6		16	6	12		6	8	3	6	
80 - 100	5	10	5	15	20	10		20	15	8	15	8		20	8	15		8	10	4	8	
0 - 20	1	3	2	4	6	2		6	4	2	4	2		6	2	4						
20 - 40	2	6	4	8	12	4		12	8	4	8	4		12	4	8						
40 - 60	3	9	6	12	18	6		18	12	6	12	6		18	6	12						
60 - 80	4	12	8	16	24	8		24	16	8	16	8		24	8	16						
80 - 100	5	15	10	20	30	10		30	20	10	20	10		30	10	20						

Gross Points = 20 **Net Points = 20 — ½ Deducted Points**

● **FORM RL-2, based on observed condition, evaluates nature and magnitude of the defects in the structural condition.**

Survey. This is a means of evaluating the nature and magnitude of the defects in the structural condition of the pavement. To use the chart the observer merely circles the most appropriate value. If the street has a street car track zone on it, the top group of numbers is used, and if it does not have a street car track zone the lower group of numbers is used. It is possible that a street may have defects of more than one category; i.e. on a street without a track zone 15 percent of the curb may be low and hold water, 50 percent of the pavement may be cracked, and 10 percent of the pavement may be scaling—a total of 10 points would then be deducted from the 20 points allotted to this section and the net points for this section would be equal to 15.

Form RL-3, Life Economy Section: The purpose of this section is to evaluate the maintenance economy vs reconstruction. The City of Milwaukee is very fortunate in having an established system of records with a complete compilation of all paving history, costs, lengths and areas on Remington-Rand Kardex cards, with a card for every block and intersection in the city. (See "Milwaukee's Street Inventory Record" by Raleigh W. Gamble. *Engineering News-Record*, January 10, 1946).

We also have all this paving information on business machine punch cards and have run mass tabulation studies of pavement lives. We have available curves that give us the average life of any type of pavement for any year of construction. In using Form RL-3, we first write in the type and year of construction from the information on our visual Kardex records, and then secure the average life of that particular pavement from the survivor curves mentioned previously. We then compute the probable life taking into account the percent of the original number of square yards of pavement still in service and using either the probable life curves available in Bulletin 125, Iowa State College "Statistical Analysis of Industrial Property Retirements" or those furnished by the Bureau of Public Roads. We then compute the probable life of that portion of the pave-

CITY OF MILWAUKEE
BUREAU OF ENGINEERS - STREET CONSTRUCTION SECTION
ROAD LIFE STUDY
SUFFICIENCY STUDY
LIFE ECONOMY SECTION

DATE_____

STREET_____FROM_____TO_____

1. Type of Pavement and Year Constructed:_____
2. Average Life From Survivor Curves _____Years
3. Probable Life = (2) Average Life x Percent of Average Life (From Standard Mortality Curves) _____Years
4. Age of Pavement _____Years
5. Life Expectancy (3-4) _____Years
6. % of Area Repaired _____ %
7. % of Area Requiring Repairing _____ %
8. Future Traffic Conditions
   a. Low Traffic Volume & Weights _____
   b. Average Traffic Volume & Weights _____
   c. High Traffic Volume & Weights _____
9. Estimated Remaining Service Life _____Years
10. Life Economy = Estimated Remaining Service Life (9) x $\frac{2}{3}$ = _____Points

● **FORM RL-3 aims to evaluate the economy of maintenance versus reconstruction.**

ment still in service. From that, we subtract the age of the pavement in the section under consideration to determine how long the particular pavement we are considering will last. We then temper that judgment by considering the amount of repairing that has been done, the amount that should be done and the traffic conditions on the street; for example, if the life expectancy on a pavement was 12 years, 15 percent of it had been repaired, and there was a large volume of vehicles with much heavy trucking, we might estimate the remaining service life as 10 years. If none of it was repaired or needed repairs and the traffic volumes and weights were low we might expect that pavement to last 15 years. The life economy rating is then computed by multiplying the estimated remaining service life by two-thirds. This is strictly an arithmetical manipulation arrived at because the average life of most pavements in Milwaukee is 30 years and we have allocated 20 points for this section. Multiplying by two-thirds then assures us that no section will receive more than 20 points.

For cities without survivor curves, it would be necessary to estimate the remaining service life from field observations and experiences.

The ability of a street to handle the volume of traffic that wants to use it is a measure of its traffic capacity. Items 1 through 8 on Sheet RL-4 are a combination of field data and traffic counts based on the traffic curves available in the Highway Capacity Manual of the Highway Research Board. We calculate the practical capacity by multiplying the theoretical allowable vehicles per hour of green light times the cycle time (the amount of green light available per hour, to determine the number of vehicles that should get through each hour). Line 10 is our capacity ratio and we find this by dividing the practical capacity by the actual number of vehicles using the street during the busiest time of the day (the peak hour volume). The capacity rating is again arithmetical, for example, if the practical capacity is 800 VPH and the peak hour volume is 1,000 VPH, our capacity ratio is 800/1000 and the capacity rating is 0.8x40=32 points.

Sheet RL-5: The ridability of a street is the smoothness or riding quality of the pavement surface. It is a measure of the ease with which a motor vehicle can be driven over the surface with regard to bumping, slipping, etc. This can be measured by various machines now on the market. However, Milwaukee does not as yet own such a device so we rate this section by field observation.

CITY OF MILWAUKEE
BUREAU OF ENGINEERS - STREET CONSTRUCTION SECTION
ROAD LIFE STUDY
SUFFICIENCY STUDY
CAPACITY SECTION

DATE_____

STREET_____FROM_____TO_____

1. Parking: a. Prohibited; b. One Side; c. Both Sides
2. Location of Street: a. Intermediate; b. Outlying; c. Downtown
3. Type of Facility: a. Divided Lane; b. One Way; c. Two Way; d. Expressway
4. Roadway Width_____Feet
5. ADT_____Vehicles
6. Peak Hour Volume = VPH_____
7. Rated Vehicular Capacity of Street = VPH of Greenlight_____
8. Cycle Time = $\frac{\text{Seconds of Greenlight}}{\text{Total cycle time}}$ =
9. *Practical Capacity = (7) VPH of Greenlight x (8) Cycle Time
10. Capacity Ratio = $\frac{\text{Practical Capacity (9)}}{\text{Peak Hour Volume (6)}}$ =
11. Capacity Rating = Capacity Ratio (10) x Gross Points = Capacity Ratio x 40

(Note: Maximum points = 40)

*Note: Intersection controlled by traffic police or stop signs should be considered as having 50% Green Light unless the ratio of traffic on the two streets is extreme, in this case an individual study of the intersection should be made.

● **FORM RL-4 combines field data and traffic counts to measure traffic capacity.**

The safety feature of a section of a street is calculated by the formula shown on sheet RL-5. We use the actual number of accidents (both personal injury and property damage) on file with the Milwaukee Police Department for the latest calendar year and multiply it by 1,000,000, so we end up with a whole number and divide this product by the length of the section in feet times the average daily traffic count. This gives us a safety index or accident rate which we then equate to the indicated point allocation.

Form RL-6 is a gathering sheet for other pertinent information that is useful in the final judgment of a street's sufficiency and in determining its paving priority. Some of the questions asked on Form RL-6 are as follows: Will the importance of the street be affected by expressways in the near future or be affected by future annexations; is the street of importance as a civilian defense disaster route and is it on the land commission master plan; are there any special developments such as shopping centers, airports, etc.; and is it a major trucking or mass transit route and is it on any state or Federal Aid route.

The sum of all the ratings in the foregoing sections is classed as the basic sufficiency rating and the various sections of an urban street could be compared on the basis of this rating, but we in Milwaukee believe that the streets carrying the most traffic should receive precedence over those with lesser amounts of traffic. We, therefore, adjust our basic rating up or down depending on whether or not the traffic on that street is more or less than the average on the system rated (12,500 VPD). To do this we use the formula

$$R = B + \frac{B^2 - 100B}{25 \text{ Log Ts}} (\text{Log T} - \text{Log Ts})$$

Where R = Adjusted rating;
B = basic rating;
T = traffic volume in section;
Ts = average traffic volume on system.

CITY OF MILWAUKEE
BUREAU OF ENGINEERS - STREET CONSTRUCTION SECTION
ROAD LIFE STUDY
SUFFICIENCY STUDY
RIDABILITY AND SAFETY SECTIONS

DATE_____

STREET_____FROM_____TO_____

RIDABILITY

Excellent	10 Points
Average	5 Points
Unsatisfactory	0 Points
Net Points	_____

SAFETY

Gross Points 10

Accident Rate = No. of accidents 1 yr. x 1,000,000 / Length of section (feet) x ADT

= _____ x 1,000,000 / x

Accident Rate	Points
Over 5.0	0
4.0 to 5.0	2
3.0 to 4.0	4
2.0 to 3.0	6
1.0 to 2.0	8
0 to 1.0	10

Net Points _____

FORM RL-5 considers ridability and safety. Calculation of safety factor is by formula shown on the form, using both personal injury and property damage accidents.

This basic equation is used by various highway departments throughout the country to adjust the ratings on their rural highways. For example, if a section of street had a basic rating of 45 and an ADT of 15,000, the adjusted rating would be 43.1 or 43 points.

$$R = 45 + \frac{(45)^2 - 100\,(45)}{25 \text{ Log } 12{,}500} \times (\text{Log } 15{,}000 - \text{Log } 12{,}500) = 43.1$$

The effect of adjusting the ratings is to place the sections of streets in the order that they should be paved according to the use that they receive by the motorist.

We found that a practical way to decide how long a section to have on a sheet was to take lengths which have similar characteristics. For example, we would select a section where the traffic count, roadway width, pavement type and physical condition are the same or very similar. If any one of these factors is radically different it is best to break the section into two or more.

Finally, we rank our sections in the order of adjusted ratings with the worst rating being number one. We have found this sufficiency study analysis of our major street system to be a valuable tool in programming our paving, and analyzing the deficiencies on various streets. It is especially useful in locating bottlenecks on a street; for example, if the street traffic capacity is excellent, except for one section, it is very apparent by studying the comparison rating sheet and remedial action can be taken immediately.

UNUSUAL ASSESSMENT PROJECT

One of the unusual assessment projects constructed during the fiscal year 1957-1958 in Los Angeles, Calif., was the improvement of approximately a mile of Gladstone Ave. between Hubbard St. and Maclay St. Extensive development in the area and the necessity of providing a shorter and more direct route for the safety of school children who were forced to use Foothill Blvd., a heavily traveled State Highway, caused the property owners to request the improvement under assessment procedure. Portions of a dirt roadway followed the natural ground over rolling country with several abrupt drops, one of which was 60 feet. A grade was established over this terrain, which not only provided access to existing improvements on private property but which also was adjusted to the large differences in elevation. The grade involved moving 34,000 cu. yds. of earth, an unusually large amount for an assessment project. During construction an interesting problem developed at Maclay St. where a 25-foot cut intercepted a flow of underground water. This problem had to be overcome within the strict limitation of assessment work. By making use of Section 69-C of the City's Standard Specifications No. 151, it was possible to remove sub-base material as "deleterious" and replace it with "suitable material." A portion of the sub-base was excavated from a point uphill from the place where the water reached the surface to a point downhill and outside the area to be paved. The resulting trench was then filled with upgraded crushed aggregate to a depth of one-foot below sub-grade. This resulted in the formation of a subdrain to carry off the underground water and a stable base on which to place the pavement.

• • •

Regulating Subdivisions

An ordinance was recently passed by Stuart, Fla., calling for subdivisions to meet requirements of the State Road Department and local authorities. Subdivisions must be planned so that their streets interconnect with neighboring subdivisions and must provide a minimum space for residential lots of 7,500 square feet. Other regulations concern street widths, drainage, clearing, excavation, street materials, paving and provision of water and sewerage facilities.

SAFETY IN SEWAGE TREATMENT PLANT OPERATION

LEROY W. VAN KLEECK,
Principal Sanitary Engineer,
Connecticut State Department of Health

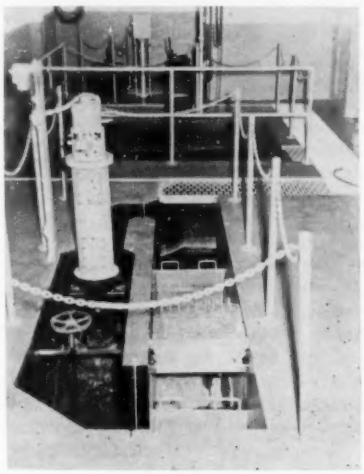
SEWAGE treatment plants have many areas where physical injuries may occur. Open settling tanks, open pits and manhole shafts, moving machinery, ladders, electrical equipment, laboratories, and the danger of fire are a few examples of potential hazards.

Guards—Fencing or chains suspended between posts are needed around open pits, open manhole shafts and settling tanks. Manhole and pit covers should be replaced promptly after work in these substructures is completed. Metal screen guards around moving machinery protect workers from being caught in chain or belt drives, pumps, motors and conveyors.

Electrical Hazards — Disabling shocks or death are possible under the right conditions even with low electrical voltages. Open switch boards should never be used, and even with enclosed boards, a heavy rubber insulating mat is needed in front of them. Unauthorized tampering with high voltage panels can be prevented by using a locked back or enclosing the panel with a locked fence. The same precaution applies to plant transformers. When working on electrical equipment, the worker should never ground himself in water or on metal pipes or drains, and the main board switch should be locked out. Furthermore, a "man-on-line" tag should be hung on the board. A summary of electrical safety is a new feature of the Federation's* Manual of Practice No. 1 (Second Edition) on "Safety in Wastewater Works" and the suggestions listed therein should be reviewed by all plant operators.

Falls—Falls from vertical ladders are common. Care in descending and ascending them is important. Vertical ladders of 10 feet or more in length can be equipped with a hoop cage, or offset ladders may be used with landings every 10 to 15 feet.

Lighting—Illumination must be ample, especially in the vicinity of steps, moving machinery, and in crowded or low overhead areas. Windows rarely provide sufficient light. Light-colored paints for walls and ceilings aid illumination. Luminous tape and buttons are helpful in hazardous locations. Not only are stationary electric lamps of ample wattage and spacing needed, but lamps with extension cords are frequently required as supplements. Flood lighting of exterior areas, with avoidance of glare and shadows, is needed for night operations.



● **CHAIN guards (in foreground) and railings (background) should be provided to protect all openings and hazards.**

Fires—Fires may occur at sewage treatment plants from sludge gas leakage, overloaded electrical circuits, faulty heating equipment, lightning, cleaning fluids, oil soaked rags or other combustibles such as paper, and from carelessness in the use of matches, blow torches, Bunsen burners and the like. Fires have also occurred at sewage plants from discharges of oil or petroleum products in raw sewage entering screening rooms. Good housekeeping is a major deterrent. Fires require a fuel, air and a source of ignition. Fire drills are desirable at large plants. Recommendations for fire extinguishers are given in the Federation's manual.

Identification of Hazards—Warning signs and colored paints protect personnel from certain hazards inherent in plant operation. These means of identification cannot be overdone, or inattentiveness will result. The following list is indicative of areas where signs might be used to avoid physical injuries: 1) High voltage lines; 2) pipes conveying high-pressure steam and hot water; 3) chemical lines; 4) steep stairs; 5) protruding objects or low overhead areas; 6) confined areas where sludge gas may accumulate in explosive proportions with air.

Safety Belts—These belts should be worn by workers entering deep pits, tanks or other deep underground structures at sewage plants. Reasons for their use were given in a previous article.*

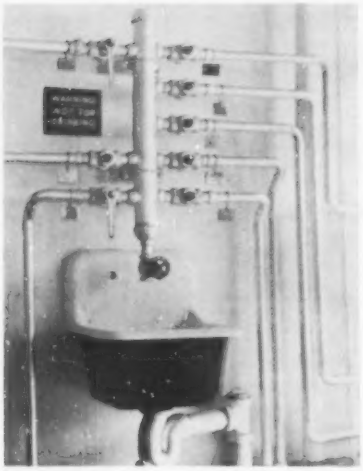
Protective Apparel — Protective apparel for sewer workers was described in the previous article.* Occasions arise when the use of such apparel is desirable for plant operators. A further listing of protective apparel is given in the Federation's revised manual.

Laboratory Safety—Safety precautions in the sewage plant laboratory have long been neglected, and very little information on this phase of plant safety has been published. Operators will find a new and useful summary of laboratory safety practices in the revised Federation manual.

Employee Practices—Good housekeeping prevents physical injuries. This means good maintenance of all equipment and a tidy plant.

*Federation of Sewage & Industrial Wastes Associations, 4435 Wisconsin Avenue, N. W., Washington 16, D. C.

*"Safety in Sewer Construction and Maintenance." PUBLIC WORKS, May, 1959.



● **SIGN on wall warns that water supply is not potable and is to be used only for back-flushing the sampling piping.**

Hazardous jobs call for adequate personnel, using the proper tools, and working under the supervision of a trained foreman. Instructions for handling emergencies should be prominently posted by management. Such instructions should include emergency telephone numbers, resuscitation procedures and first-aid directions for common physical injuries. The handling of objects is a major source of compensation injuries. Employees must be taught by supervisors to lift objects with the aid of the leg muscles instead of the back. This reduces ruptures and back injuries. Heavy objects cannot be lifted safely except with hoists or power trucks.

Personnel Contamination

The cost of medical care for infections and from lost time among the general population in this country is unbelievably high. In addition to the usual body infections in any occupation, sewage plant employees are subjected to additional potential hazards. These include typhoid fever, paratyphoid fever, amoebic dysentery, infectious jaundice and the danger from tetanus. The recommendations for prevention of infections among sewer maintenance men apply to sewage plant personnel. In addition, constant vigilance within the plant is necessary on the part of plant supervisors to avoid all physical cross-connections between potable water supplies and piping or facilities containing sewage, sludge or other filth. The wearing of rubber gloves should be mandatory when workers have to place their hands in sewage, clean sludge pumps or handle screenings and other contaminated materials at sewage treatment plants.

Dangers from Gases

Oxygen Deficiency—Oxygen deficiency may occur in any confined space, such as a manhole or enclosed tank. It is generally caused by displacement of the air with some other gas, whether this gas is toxic or not. Basically, oxygen deficiency is the result of poor ventilation. Oxygen deficiency is detected by using a specific indicator equipped with an aspirator and sampling hose. Flame safety lamps (Miner's lamps) and birds or animals are not safe detectors and should never be used.

At sewage plants oxygen deficiency is particularly likely to occur in poorly ventilated rooms (especially basements) where digested sludge spillage has taken place, in partially emptied sludge digesters, or in structures containing sludge gas piping or appurtenances that may be leaking. In these locations an explosion hazard is also likely to exist, although if a serious oxygen deficiency already exists, the concentration of sludge gas may be temporarily above the explosive range. (The explosive ranges of flammable gases are fully described in the Federation's manual.) Oxygen deficiency can occur even in shallow pits where no gas leakage, as such, is occurring.

The avoidance or correction of an oxygen deficient atmosphere is through ample ventilation. If diluent gases are present, the source of leakage must be corrected. Open windows, stationary mechanical force-draft or exhaust systems, compressed air and portable air blowers will supply ventilation. Gravity or wind-blown duct ventilators are not always effective in providing safe ventilation in structures.

Noxious Gases or Vapors—Any gases or vapors that are directly or indirectly injurious or destructive to the health or life of human beings are considered noxious. They may present a hazard by causing burns, explosions, asphyxiation or poisoning. The characteristics of the various gases and vapors encountered in sewage works practice are detailed in the Federation's manual.

Danger Spots—At sewage plants, among the most likely locations of noxious gases are screen, grit or comminuting facilities in enclosed areas. Sewage is present in these areas and it may be conveying volatile solvents, gasoline or other petroleum products.

Any location where freshly drawn digested sludge is exposed to the atmosphere in a confined area is likewise a danger spot. Examples are spillage of digested sludge from pumps or discharge of digested sludge to open tanks. Noxious gases or vapors are also likely to be found in the interior of partially emptied digesters containing digesting sludge; filled digesters from which sludge gas is leaking, a fire hazard if a source of ignition exists; sludge gas piping and appurtenances in confined areas, where gas leakage may occur; and chlorine storage rooms.

Explosive Conditions—Four conditions must exist; the absence of any one will prevent an explosion: 1) Presence of flammable gas; 2) presence of air (oxygen); 3) a mixture of gas and oxygen in the proper proportions; and 4) a source

● **SHIP ladder shown here is safer than a vertical ladder for access to this control chamber. Also note railings around the settling tanks shown in the background.**

of ignition (open lights, sparks, hot filaments, etc.).

Avoiding Dangers from Gases—The most suitable means for avoiding the danger of noxious gases or vapors depends on the location. The following measures should be taken for the danger spots listed above:

1) With screen, grit or comminuting facilities in confined areas, use explosion-proof electrical equipment; ban smoking or open lights; and provide ample ventilation.

2) In working with digested sludge in confined areas, avoid sludge spillage from sludge pumps. Provide ample ventilation. When open digested sludge storage tanks are used in confined areas, the recommendations under (1) should be followed. In addition forced draft ventilation and/or automatic combustible gas alarms may be desirable.

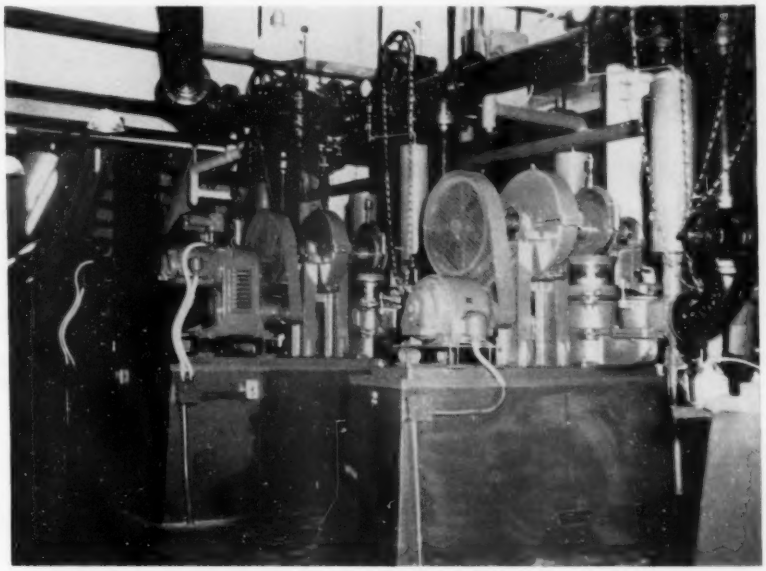
3) With partially-emptied digesters, avoid entering tanks, if at all possible, until practically all sludge is removed. Test for flammable gas and hydrogen sulfide; also for oxygen deficiency. While work is in progress inside the digester, introduce air from an air compressor or portable air blower through a manhole with all other manholes open, unless repeated tests indicate that natural draft is maintaining a safe atmosphere.

4) In filled digesters from which sludge gas leakage is occurring, stop the leak if possible. Prevent the continuous operation of roof gas pressure relief assemblies by adjusting the waste gas burner pressure relief to take all unused gas through the waste burner. Avoid all sources of ignition in the vicinity of the leaks. Signs should be erected in the vicinity of all digesters banning smoking, open lights or other sources of ignition.

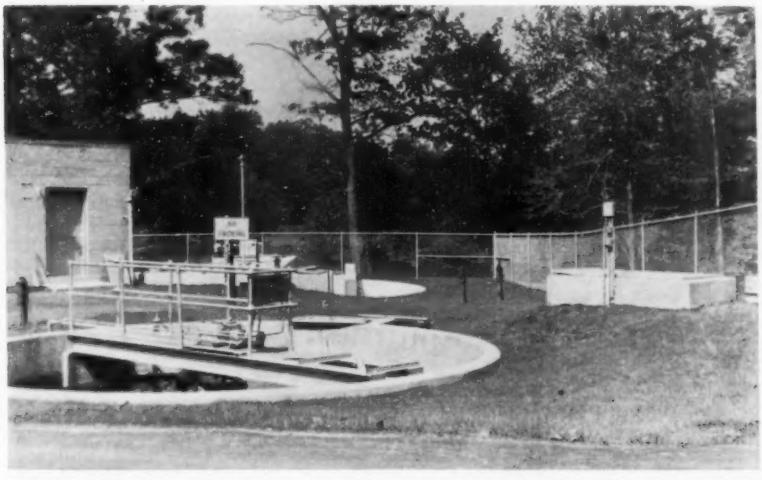
5) Where sludge gas piping and appurtenances exist in confined areas, check the entire system for gas leaks periodically with a portable combustible gas indicator. Maintain a positive gas pressure in the pipes. Use only factory-built, approved (permissible) types of manometers, condensate traps, pressure regulators, gas compressors and flame traps and give them regular maintenance. Check gas boiler safety devices regularly, especially the pilot or ignition-safety cut-off.

6) In chlorine storage rooms, check for chlorine leaks daily. Remember that chlorine is a severe irritant but it will not burn or explode with air. Use mechanical exhaust fans drawing suction from near the floor of large chlorine storage rooms (chlorine is heavier than air). Have at least two chlorine canister masks available outside the storage room. A hose mask or demand-type mask, using compressed air or oxygen, should be available for serious leaks. All masks should be checked and serviced regularly, and practice drills held periodically in using them.

Safety equipment for these hazards such as respiratory-protective apparatus, non-sparking tools, artificial respiration and inhalators are fully discussed in the Federation's revised Manual of Practice No. 1.



● **GOOD lighting is one of the prime elements in a safe plant, especially near machinery, on steps and in crowded areas. These sludge pumps are well lighted.**



● **SIGN warns against smoking in vicinity of sludge digestion tank in the background. If tank is partially filled, an explosive mixture of gas and air may exist.**

Thoughts for Management

1) An important responsibility of management is the periodic inspection and maintenance of the fixed safety features provided in the plant's design. These built-in features cannot render continuous service without proper attention.

2) Thorough investigation of all accidents is fundamental in a plant safety program.

3) It is well to remember that accident news is unfavorable news. Such news is a reflection on management.

4) The initial action for accident prevention and an adequate safety program must start from management.

WARREN J. MANN,
Director of Public Works,
Raleigh, North Carolina

KEEP URBAN HIGHWAYS IN STEP WITH THE NATIONAL PROGRAM

● **INTERCHANGE leads from Daniels Street and Glenwood Avenue to US Highway No. 1, which carries as many as 20,000 VPD, with 13% of total between 5 and 6 PM.**

THE STATUS and magnitude of the Urban Highway Program in any state or urban area is dependent largely upon the status and magnitude of the National Highway Program. Therefore, a look at the program at the national level is desirable. For the six fiscal years, 1956 through 1961, it is planned that there will be available a total of $10.750 billion for the ABC program, including state matching funds. It is estimated that these funds would improve, to tolerable standards, about 185,000 miles of roads or about 24 percent of the primary, secondary and urban road needs.

For the same period there would be available approximately $11.5 billion for the Interstate System, which would provide funds to improve, to 1975 requirements, about 11,800 miles of roads or about 29 percent of the total of 41,000 miles. Percentagewise the ABC and Interstate programs are about in balance.

In North Carolina all public roads outside of the corporate city limits of the municipalities are directly under the State Highway Commission. There is no such thing as county road organizations in the state, meaning that there are only urban and state highways in North Carolina.

All streets in the corporate limits of municipalities, carrying a marked highway, are considered a responsibility of the State Highway Commission. The Highway Commission allocates a certain amount of funds based on one-third mileage, one-third population, and one-third needs for maintenance of these highway-marked streets. The construction or re-construction of the highway-marked streets is accomplished by the State Highway Commission, almost entirely by the contract system.

For the construction and maintenance of other streets in the city, the state is required by legislative action to allocate an amount equal to one cent of the seven cents state gas tax to the various municipalities, based entirely on street mileage.

To get a clearer picture of how the allocation of funds to state and urban highways in North Carolina is accomplished, it is necessary to review the Federal Government treatment of the problem of apportionments of federal moneys.

Prior to the 1956 Federal Highway Act, there was in operation two systems of apportioning Federal Aid money for the regular ABC program. It consists of three parts-area, population, and mileage of RFD routes. Each of these three factors is given equal weight in apportionments. When considering the apportionment of federal money for urban extensions of the ABC system, it is obvious at a glance that some modifications are needed, for area and RFD mileage have little to do with the highway needs of a city. Therefore, apportionments for urban highways are based on urban population within a state, in cities, and other urban areas with a population of 5,000 or more.

The House Subcommittee on roads of the Congress held exhaustive hearings to find a solution to determine how apportionments for the Interstate System were to be made. It became more apparent as these hearings progressed, that there was a specific job to be done and, in the words of the law, the intent of Congress was to bring the job to "simultaneous completion" in all states. Therefore, when the mileage for each state was established, by previous estimates, the apportionment of money to each state for the completion of the Interstate Highway Program could be determined relatively accurately. It has been estimated that urban mileage accounts for approximately one-tenth of the Interstate System's total length, while nearly one-half of the total cost of the entire system is estimated to be spent in urban areas.

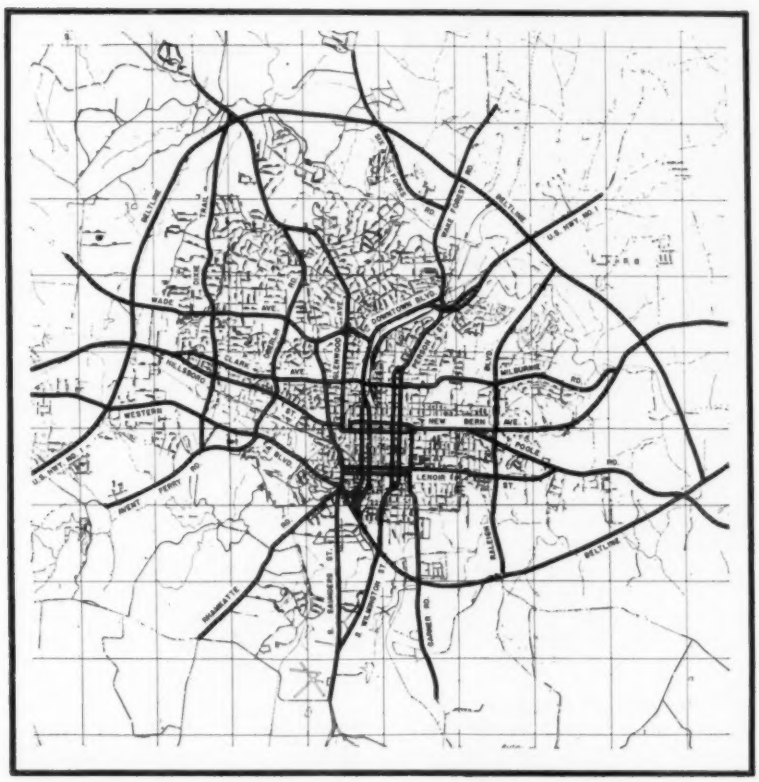
The major, and most difficult, problem with respect to the Urban Highway Program is the matter of timing. There were those who be-

lieved that a slow and cautious approach in metropolitan areas was proper and necessary. It has been long recognized that a well-coordinated major street plan should be part of a comprehensive plan for all phases of urban development. In Raleigh, the City Government has control of all real estate developments within a two-mile area of existing city limits at the time of such development. This provision for regulation, granted by the State Legislature, makes it possible to have all developments tie in with the major street plan of the city. It should be recognized that several years are usually required to gather basic data and to develop initial programs to provide for future urban growth and needs.

The $7 billion annual pace in the National Highway Program, in all probability, will have to be more than doubled if the nation's needs of 1975 are to be met. In addition to contract estimates, engineering, rights-of-way and administration costs are subject to the national inflationary trend. Too, the urban expansion and rising population can contribute to these excessive costs. The Annual Treasury Report on the status of the Trust Fund, points to a total deficiency, through 1973, of $13.3 billion, taking into account only 40,000 miles of the Interstate System. Including the other 1,000 miles would have increased the expected deficiency to $14.3 billion.

Even though the City of Raleigh was not fortunate enough to be on the Interstate System, it is very evident that urban traffic on one of the busiest thoroughfares is much greater than on any other state-marked urban highway in North Carolina. A recent traffic count on US Highway No. 1 North, generally referred to as Downtown Boulevard, recorded 31,000 vehicles over a 24-hour period. It was estimated that the morning peak from 8 a.m. to 9 a.m. would average approximately 10 percent of this total count, while the afternoon peak between 5 p.m. and 6 p.m. would be approximately 13 percent of the total.

● **JUNCTION of US 70 and US 1, two heavily traveled arteries. Proposed by-pass or beltline will relieve present downtown traffic problem which is now very severe.**



● **BELTLINE proposed for Raleigh, as shown on above map, will intercept major highways now bringing through traffic into downtown streets and creating congestion.**

Proposed Beltline

The proposed bypass or beltline, which is a more familiar term, of the City of Raleigh will serve as a great relief to the present downtown traffic problem. At the present time, all highways leading into the city are routed through the downtown business area. The beltline as outlined on the major thoroughfare plan is at its infancy, in the planning stage. It is possible that one small segment of this bypass circle will be let to contract during this coming construction season. Rights-of-way, real estate speculation, property damages, etc., in all probability, will prolong the completion of the entire circle beltline, consisting of approximately eighteen miles, over a period from five to seven years, placing a great burden upon the capacity of our streets in the downtown area. Such conditions and situations are a far cry from an old definition of a city street, which was defined to be an area in a municipality for burying pipes or as that portion of earth's surface reserved for digging up and re-laying.

HEALTH INSURANCE

BENEFITS FOR COUNTY EMPLOYEES

PAT THOMSON,
Douglas County Engineer,
Waterville, Washington

ACCORDING TO a recent survey, the cost of medical expense has increased 25 percent while other costs of living have increased eight percent. Although many people have health insurance, it is still not readily available to one group that needs it most—the lower wage group of state and county officials.

Recognizing this fact, the Washington State Association of County Commissioners took advantage of Chapter 106, Laws of 1957, allowing county participation in group health insurance, to investigate the establishment of an employee group insurance benefits program. After a great deal of study, the Association came up with a plan that covers Group Life, Accident and Sickness, and Major Medical Benefits for all employees and their dependents. The policy on a state-wide basis is underwritten by the Mutual Life Insurance Company of New York. Because this is offered through the Association to all counties of the state, it is possible to include a wider range of benefits at a much lower cost than the employee could afford as an individual. In addition, the separate counties pay a portion of the employee's cost—usually the single employee's premium amounting to $5.11 per month.

It was found that employee group health insurance is in a class by itself. Rarely is it ever sensible for a group of employees to pass it up. Such group insurance gives the individual protection at bargain rates due to the contribution which the county makes toward the premium, and to the economics of underwriting such a blanket plan. It allows the employee, who might otherwise be denied coverage due to a bad medical history, to come in under the plan on a 31-day inclusion clause. It will even include the employee, who by reason of age, would find it impossible to acquire individual coverage.

● **COMMITTEE of Washington State Association of County Commissioners that investigated and established the insurance program. Standing, left to right: Roy Nelson, Douglas county; Bob Bandy, Lincoln county; Chet Gardner, Cowlitz county; and Willard Wyatt, Snohomish county. Seated, left to right: Al Widmer, Grant county; Tab Murphy, Grays Harbor county, and George Huntingford, Jefferson county.**

The big difference between group and individual policies is that there is no real contract between the employee, the county or the company. The company agrees to insure all the employees of the county. The county agrees to pay one premium at the end of each month through employer contributions and individual payroll deductions. The master contract involves the Commissioner's Association and the company, with each individual supposedly receiving a membership certificate attesting his rights under the policy. All permanent employees were automatically included without medical examination. New employees will be included after a two-month period of continuous service.

An arrangement such as our counties have operates under a group term policy. It is actually issued on a one-year basis, cancellable by both parties upon appropriate notice. Such a policy has no cash value, it will acquire no paid-up values, and premiums may increase as rates of claims or ages of employees increase.

Protection Provided

The first point of investigation for any governmental agency considering employee group insurance is: Will the type of policy chosen provide the protection wanted when the employee needs it? A salesman's description of his policy's benefits do not always agree with the policy's fine print restrictions. An indication of a reliable firm is noted in a detailed description of the policy's restrictions as well as benefits. One will soon discover that no complete coverage policy is available. Every policy with every company is limited in some respects. Specific medical aspects may be eliminated as, in our county, maternity benefits are not included. In some, the employee can be injured only while performing regular duties, while others cover all activities. In a Health Information Foundation study involving 2809 families and 8846 individuals it was found that most policies provide much less then complete coverage. Only seven percent received more than four-fifths of total expense; 32 percent received from two-fifths to four-fifths of total expense; and 61 percent received less than two-fifths of total medical expense.

However, a group benefit program should be reviewed from the standpoint that it is only practical to cover those medical events that are predictable for the large group and not predictable for the individual. There must be a limitation to the extent of coverage desired. If we are trying to devise a policy covering all facets of modern medicine, then we must certainly expect to pay a more costly premium.

How complete, then should a county group policy be? In hospitalization, it should cover the local costs of a semi-private room, board, and the necessary extra services. Confinement periods should not be too low, nor should it exclude general illnesses. It should make sure that full coverage of dependents is available if desired. Surgical payments should be in line with local physician fees. In major medical expense, dread diseases should be covered, with the maximum $5000 or above. The employee deductible amount should not be too high. And in this respect, the policy containing the deductible amount as a sliding scale percentage of earnings, should be looked at carefully. In reaching the dread disease stage of the coverage, the deductible amount should be small, not over $200, nor should the employee be required to pay too great a percentage of the remaining amount above the deductible—not over 20 percent.

● **WILL the policy include dependents of employees? In our policy, maternity benefits are not allowed, but your negotiations could include them.**

● **HOW about accidental injuries to dependents? This young man, caught in a moment of repose, plays right half for the high school football team. Is this activity covered by the policy?**

● **ARE all employee classes covered without restrictions? Field and office personnel both need health insurance.**

From the standpoint of the employee, these major points will provide the best coverage. Is the policy renewable? In most states, the right of cancellation is clearly stated under Provision Sixteen. This clause gives the company right of cancellation at the end of any year or any policy period. Most companies will claim that the right of cancellation is seldom exercised. However, policies have been cancelled because the individual, in the terms of the company, has become an impaired risk, or because there has been a repeated number of claims of a recurrent type of disease. If there is any doubt about the renewability of a policy, a letter should be requested from the company fully stating the facts of cancellation.

Receivable Benefits

What are the receivable benefits? Does the policy include amounts of life insurance, accident, health, surgical, and/or disability payments? If so, what are the character and amount of each? Will the indemnity payments for hospitalization cover both accident and illness? There is a vast policy difference in the meanings of "accident and illness" and "accident or illness" and this is another point that should be completely clarified. Most policies place a limit on the amount of benefits paid for any one continuous disability. Contracts usually contain a stipulation that recovery from any given condition must extend over a six months period for it to be considered a new disability.

When does coverage take effect? In most cases, the date of effect is 30 days after the day of policy. Generally, coverage will not extend to disabilities in effect before the policy issuance. And often a recurrent non-reported problem may be reason for cancellations.

The company issuing the policy or its representative should be relatively easy to contact. In the case of our policy, we have experienced some difficulty in contacting the sales representative and in getting information from him. And though we are probably wrong, we have interpreted this as a lack of knowledge on his part of his product, and a reluctance to meet our problems.

Should the employee quit or retire, what are the conversion features of the policy? Will he lose the policy at retirement when he needs it most? Or can he then convert to an individual policy without a medical examination?

Having answered all of these questions, then we should arrive at a policy providing the coverage shown in Table 1.

Table 1—Benefits Available

	Employee	Dependents
Life Insurance**	3000	
Hospital Benefits		
Daily Room & Board	15	$15
Miscellaneous	300 Max.	300 Max.
Surgical	300 Max.	300 Max.
Physician Benefits		
Office	3	3
Hospital	5	5
Home	5	5
Maximum	250	250
Accident	300	300
Major Medical Max.	5000	5000

**If employment is terminated, life insurance can be converted to an individual policy within 30 days. If disabled before age 60, life insurance continues and is payable if required proofs of disability is shown.

To arrange for such employee insurance for your employees, contact all companies offering hospitalization policies containing both accident and sickness coverage, provided the company is licensed to do business in your state, and provided the company shows good financial conditions. Thorough investigation on the basic above points will give your employees a group benefit policy that will certainly be a great aid to them, and it will also provide the employer with an excellent bargaining point.

● ON PRESENT 2,250 miles of Massachusetts highways, there are 16,000 acres of grass to mow. Chemical weed killers have reduced mowing costs.

REDUCING ROADSIDE MOWING COSTS WITH CHEMICALS

JOSEPH L. BEASLEY,
Highway Landscape Supervisor, Massachusetts Department of Public Works

From a paper presented at the Northeast Weed Control Conference held in January 1959.

WEED CONTROL is important in all categories of roadside maintenance. Along a secondary highway, or "country road," we generally like to keep the roadside as close to its natural state as possible, consistent with safety and efficient maintenance. In direct contrast is the industrial or commercial highway where beauty competes with utility and efficiency. The state highways of Massachusetts fall in between these two extremes. The people of Massachusetts insist on well-groomed highways, in keeping with the three-century tradition of having a village green in the middle of every town. But at the same time, their Yankee thrift demands that this scenic beauty be achieved at the lowest possible cost.

As a result, the State Department of Public Works has 16,000 acres of roadside grass to mow every year along our present 2,250 miles of state highway. The 90 miles presently under construction will add another 1,800 acres of roadsides. In 1958, the bill for mowing the 16,000 acres was $700,000, an average of $44 per acre —and this was the lowest mowing cost for any year to date, even with the increasing road mileage and rising wage rates.

Since 1951, Massachusetts has been using and experimenting with chemical weed killers in an effort to reduce mowing and maintenance costs. We have used 2,4-D, 2,4-D plus 2,4,5-T, Maleic Hydrazide, Telvar D. W., Diuron and Ureabor. All have been used with varying degrees of success. We have learned that each has its place in maintenance as a useful tool. Herbicides in themselves are not a "cure-all". When properly used, however, in combination with other roadside operations, the result is a more pleasing roadside appearance at a considerable saving financially.

Massachusetts is a pioneer in the field of mowing grass by contract. After a number of trials and revisions, we now feel that we have the best contract mowing specifications in the country. It is this combination of mowing by contract and the spraying of herbicides that has effected our greatest reduction in mowing costs. Therefore, in order properly and economically to maintain the grassed areas of the future 450 miles of interstate highway along with a large portion of the 2250 miles of our State highway system, it will profit us to concentrate even further on our herbicide program.

These mowing contracts call for a maximum of eleven cuttings on certain grassed areas and a minimum of one on other grassed areas.

Item 1—Lawn Type Mowing, eleven cuts per season, includes: Median stripes; bowl areas; dividing strips at ramp; traffic islands; and rotaries.

On the above areas the total width, or on wide median strips and bowl areas, a maximum width of 30 feet from all roadways is mowed under this item.

Item 2—Roadside Hay Mowing, five cuts per season, includes: A minimum width of 15 feet of grassed area on the roadside and not over

● SOIL STERILANTS are used along guard rails. Doing the job by hand is very costly. One hour of soil sterilant spraying eliminates 80 hours of hand trimming.

5 feet but always including this 5 feet on cut slopes and the portion remaining uncut from Item 1 in all areas outlined from Item 1 mowing.

Grass directly in front and in back of guard rail is mowed so that the guard rail is clearly outlined.

Item 3—Hay Mowing, One cut per season, includes: All grassed areas not covered under Items 1 and 2.

Contracts for some secondary routes call for Items 2 and 3 only.

Poison Ivy Control

Our first use of chemicals along our roadsides was directed against poison ivy, at the time an extremely serious problem. Through the use of 2,4-D and 2,4,5-T, this problem has been practically eliminated. This fact not only has been reassuring to the 3,000,000 people who enjoyed our 300 roadside rest areas last season, but greatly reduced the lost "man-hours" of our department employees who are engaged in roadside work.

Then we began the selective control of other weeds and have experimented with 2,4-D and M-H-40 in our constant effort to reduce the number of annual mowings. Unfortunately, we haven't found any chemical lawn mowers as yet. But we have found that some weeds grow a good deal faster than grass, particularly in dry years.

Through a combination of applying 2,4-D to eliminate dandelions, ragweed and other succulent weed growth on our median strips, and by revising our specifications for contract mowing, we have been able to reduce the number of mowings on Item 1 from 15 cuttings per year to 11. Reducing the amount of hand work has resulted in more efficient use of mechanical mowers. In 1958, we had 25 mowing contracts for 500 miles of highway, involving 7,000 acres of roadside. In 1959, we will expand this program.

It is the intention of the Department to treat all roadside, median strip, ramp road and traffic island grassed areas, subject to contract mowing, with weed control chemicals for the elimination of weed growth. Two applications of chemicals are planned for the season. As these areas may not be mowed for 72 hours before treatment, or 48 hours after treatment, it becomes necessary to coordinate these two operations so as to insure the least inconvenience to all parties concerned and produce the most profitable results.

Our state highway system has approximately 900 miles of guard rail. One hand trimming along a mile of guard rail may take eight man-hours, and the job may have to be done five times per season. With this chemical program, we can go along the guard rail with a power sprayer covering a band two feet wide at a rate of 1½ to 2 mph. A 2-ft. band a mile long is about a quarter of an acre, so four miles of guard rail means an acre of spraying. In other words, one hour of soil sterilant spraying, at 2 mph, eliminates eighty hours of hand trimming. And the job is done once for the whole season. Our present program calls for treating a 2-ft. strip along all our guard rails in this way, with a follow-up treatment where needed a year or two after the first application.

We now have had five years of experience with this specialized use of chemicals—beginning with a small trial in 1953 along guard rails and in the joint at curb facings. The curb treatment remained effective for one year, and the guard rail treatment for over three years. By 1957, we had treated about 420 miles of guard rail—or over 100 acres, and in 1958, we have done 745 miles, or about 185 acres. We also followed up some of the earlier treatments with Ureabor for hard-to-reach locations, and places we had missed entirely. We have learned that soil sterilants of the granular type play an important role in the roadside development program.

The soil sterilant program has been so successful on guard rails that we are adopting the same kind of treatment to eliminate hand trimming around poles, ledges, delineators, curbing, piers, abutments and other structures. We are also trying this approach for weed control in waterways, drainage ditches, gravel sidewalks and along fences.

In treating nearly 900 miles of guard rail in Massachusetts with soil-sterilant type herbicides, there have been no mishaps when the material was properly applied.

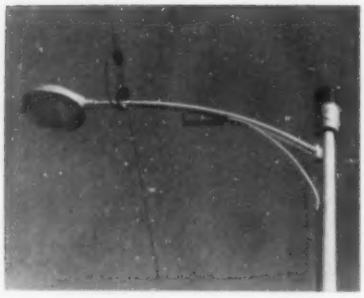
We have had a few instances of damage to turf outside the treated areas, and all of these have been traced to faulty application. The absence of curbing, gutters and culverts may direct drainage and runoff in such a way as to create problems. Established cover of grass and weeds in and around the treated area is an important factor in holding the chemical where it is sprayed. Pavement close to the treated areas presents a special problem. For example, if you accidentally spray your weed killer mixture on the pavement, the chemical merely dries on the surface. Then the first good rainstorm can wash it over to an area not intended for treatment.

We have held many meetings in our various districts to instruct engineers and foremen in the proper use of these materials, and to exercise proper precautions in applying them. The variety of chemicals available, and the specialized jobs of each, have placed a premium on expert knowledge in selecting and applying them. In general, it appears that contractors and owners of spraying equipment should see to it that their personnel become more familiar with the various herbicides. We are trying to train our local foremen so that they can do many of the little jobs with chemical weed killers. The soil-sterilant work, for example, can be done almost any time of year with available manpower so it provides fill-in work for a small crew instead of seasonal work for large crews. If applications are made before growth starts in the spring, then summer work on the treated area is eliminated entirely. In other words, you can kill weeds before they start to grow.

● **WEED CONTROL** chemicals are used on roadside, median strip, ramp road and traffic island areas. Weeds grow faster than grass and control reduces mowing costs.

HOW A SMALL CITY *MODERNIZED ITS DOWNTOWN* STREET LIGHTING

RICHARD R. STALEY,
Administrative Assistant,
Corcoran, California



● **OVERHEAD wiring is placed at ends of bracket arms to clear all projections.**

A DETAILED recapitulation of our "do-it-yourself" downtown street lighting modernization program may assist other cities of 5,000 population in establishing similar programs. Although the specific conclusions we reached may not be valid for other locations, we believe that the steps we followed have universal application.

First, of course, it was necessary to determine what kind of basic lighting would be used: Incandescent; mercury-vapor; or fluorescent. We found this our most difficult decision since it involved such intangibles as aesthetics and community pride. The City Council's recognition that the national trend appeared to be in the direction of fluorescent lighting was balanced by the fear of rapid obsolescence of the fixtures due to the constant design changes made by the manufacturers. Merchant complaints against the "old" mercury-vapor lamps were checked by investigating the "color-corrected" and "white" lamps. Finally it was decided that the lighting which delivered the most light per dollar would be used.

Our main street is 66 feet wide from curb-to-curb and consists of blocks 300 feet long. Using the standards established for street and highway lighting by the Illuminating Engineering Society we designed three systems for comparative economic studies. The detailed cost analysis is shown in Table 1.

Energy charges are based on 1.3¢ per kw-hr for 4,000 hours per year. Costs are for equipment and materials in the San Joaquin Valley of California. The annual maintenance expense is considered constant. Amortization is based on a 10-year life for pole materials, assuming no salvage value and without an interest factor. We were determined to plan never again to fall behind in our street-lighting!

Mercury-vapor lighting proved to be lowest in cost and highest in average illumination (approximately 1.85 foot-candles using a maintenance factor of 80 percent and the effective lumen output of the lamp.)

Incidentally, by expending 50 cents for the manual "American Standard Practice for Street and Highway Lighting," published by the Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y., and by obtaining free the catalogs and photometric data of the various manufacturers, we found ourselves able to design our system, recognizing that in a City of our size we had none of the technical problems that would be likely to require the services of professional lighting and electrical engineers in larger cities.

Having selected our basic system, the next step was detailed design. Our finances were insufficient to enable us to install underground wiring which we knew to be vastly superior to overhead wiring. Conventional overhead wiring, however, involved clearance and safety problems because our main street, like many others, is cluttered with neon signs, canopies and other projections that reach almost to the curb line. By combining several ideas that had previously been used individually, we developed a rather unusual system.

Our overhead wiring is placed at the ends of the bracket arms near the luminaires, rather than at the poles. This gave us necessary clearance from all projections, and more important, provides an additional five feet of fire-fighting space at the store fronts. At the ends of runs and at selected intermediate points we returned the wiring to heavier dead-end poles to anchor the wiring. We omitted the standard pole top fitting and in its place used an aerial ballast with a pole top adapter.

Our wiring enters the underside of the bracket arm at the luminaire, runs to the pole top ballast, then back out. Sub-feeds to the luminaire run inside the bracket arm and to maintain voltage separation we used BX cable for these. With the pole-top ballasts we were able to eliminate the more costly transformer base poles.

It is the policy of our City to advertise all work for bids. We prepared comprehensive specifications which permitted the major manufacturers to bid on equivalent items, and awarded the contract to the lowest bidder. In our case we ended up with Weld-Rite Company poles and General Electric Form 400 luminaires with J-I lamps.

City forces poured the footings, assembled and erected the poles and fittings. We contracted with a local electrician to install the wiring. Our final cost, complete and in operating condition, was $305 per unit.

Table 1—Detailed Cost Analysis

	Incandescent 10,000 Lumen 50′ o.c. Staggered	*Mercury Vapor 60′ o.c. Staggered*	*Fluorescent 100′ o.c. Opposite*
No. of Units	7	6	8
Approx. Unit Cost (Installed)	$ 325.00	$ 458.35	$ 480.00
Approx. Total Cost (Installed)	2,275.00	2,750.00	3,840.00
Total Annual Energy Charges	214.00	124.00	187.00
Total Annual Lamp Replacement	23.00	67.80	41.00
Sum of Items 4 & 5	237.00	191.80	228.00
Total Annual Amortization	133.00	174.00	284.00
Total Annual Cost (Items 6 & 7)	370.00	365.80	512.00

THE GRANITE STATE LOOKS TO ITS HIGHWAYS··

BRUCE D. ZIMMERMAN,

Fay, Spofford & Thorndike, Inc., Consulting Engineers, Boston, Mass.

FOLLOWING a comprehensive master plan conceived to satisfy growth potential over the next twenty years, the State of New Hampshire is building a network of roads and highways that may soon become as strong an attraction as its scenery, its low taxes and its rural atmosphere. Two factors account for this surge of highway construction: 1) A significant growth of industry in the state that can best be sustained by expanding such public works programs; and 2) the financial provisions of the Federal Interstate Highway Program, making such ventures possible.

In brief, the ultimate objective of the state is a four-lane, limited-access, high-speed interstate highway that will bisect the state, with trunk lines and by-pass roads to carry the feeder traffic. This main artery will begin near Salem Depot on the Massachusetts state line and run diagonally across the state to Littleton in the northwest corner. Laterals will extend in an east-west direction near Manchester and Concord. The Interstate system is being co-ordinated with the recently completed F. E. Everett Toll Highway and will thus provide motorists with a selection of direct routes to practically any area of the state.

At the present time, construction is well under way on several sections of the system. Other sections are in various stages of design and the remaining portions are scheduled for future design and construction.

Concord to Hopkinton

One of the first areas to be started under the program is a 4.337 mile stretch between Concord and Hopkinton of what is now called Interstate Route 89. The construction cost of this section is $2,705,888. Engineered by Fay, Spofford & Thorndike, Inc., consulting engineers of Boston, Mass., this section begins east of Clinton Street in Concord and extends westward to Jewett Road in Hopkinton. Along its route are road relocations, interchanges, bridges, rock cuts, and even a rowing channel for a private school. It is also the first New Hampshire highway project to utilize photogrammetric topographic maps as the basis for computing contract quantities for cuts and fills.

The four-lane dual roadways, divided by a medial strip varying in width from 40 to 90 feet, are constructed on a foundation consisting of 12 inches of bank-run gravel and 12 inches of crushed gravel. The paving includes three inches of asphaltic concrete base and 2½ inches of bituminous wearing course. Its maximum gradient is three percent; its maximum curvature, two degrees; and its maximum design speed, 70 mph.

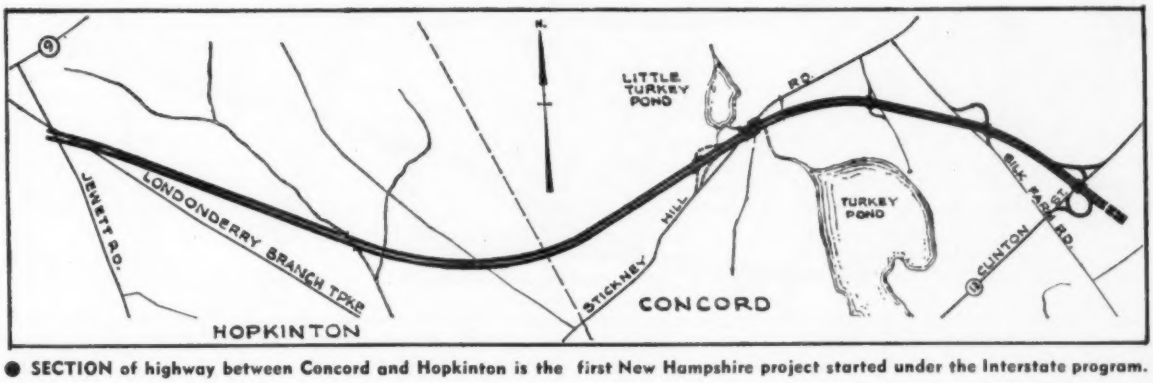
There are two interchanges in this section. One is at Clinton Street for access to the west, the second at Stickney Hill Road for access to the east. Neither is a full interchange because of the proximity of the F. E. Everett Toll Road.

Road relocations and reconstruction are extensive. Approximately 2,500 feet of Clinton Street are being reconstructed below the level of the new road and connected to it by ramps. The relocation of Silk Farm Road for a distance of nearly 2,150 feet is actually a temporary measure. Since the state has plans for a future major interchange at this location, the present roadway and bridge are located so as to require a minimum of change in the future.

In place of an existing lane now blocked by the new route, a depressed access road 12 feet wide and 1,100 feet long is provided for St. Paul's School. A 120-ft. long, 12-ft. square concrete box underpass tunnels under the Interstate highway and connects the campus with the school's recreational facilities on Big Turkey Pond. Also, a bridge is required over the new channel between Big and Little Turkey Ponds which was constructed recently by St. Paul's School.

The 2.917 miles of construction west of the Stickney Hill Road interchange to the junction of Jewett Road is uninterrupted by road relocations or interchanges. At the Jewett Road terminus, the New Hampshire Department of Public Works and Highways assumes the responsibility for the design of the extension.

Four bridges are included in the Concord to Hopkinton project—at Clinton Street, at Silk Farm Road, at Turkey Pond, and at Stickney Hill Road. All are spilt structures, with a separate bridge for each traffic direction. Although separate piers are being constructed for each deck, the abutments are single structures. This design fulfills the State



● **SECTION of highway between Concord and Hopkinton is the first New Hampshire project started under the Interstate program.**

and Federal specifications for safety, drainage and economy. Three spans are needed for all bridges, except the one at Stickney Hill Road where a single span suffices.

The Turkey Pond bridge is the only one over water. Crossing the channel between Big and Little Turkey Ponds, three spans totaling over 235 feet in length carry each of the two 38-ft. wide roadways. The piers are reinforced concrete and rest on spread footings. Safety walks, 18 inches in width, are included on both sides of the deck, which has a minimum clearance of 15 feet above the water level.

Concord to East Concord

Before the final design of the Concord to Hopkinton route was finished, the New Hampshire Department of Public Works and Highways completed negotiations with Fay, Spofford & Thorndike, Inc., for design of a 1.2 mile project along Interstate Route 93 between Concord and East Concord. Though relatively short in length, the route is complicated by such requirements as: 1) a full cloverleaf interchange; 2) a partial cloverleaf interchange; 3) road and railroad relocations; 4) new access roads and 5) five bridges, one of which crosses the Merrimack River. This 1.12-mile job will cost $3,748,785.

Design criteria for the roadway are similar to the first project, but there the similarity ends. At the traffic circle where Routes U. S. 3, 4 and 202 converge, provisions for a future bridge are included in the design. Plans for the future also affect the nearby full cloverleaf interchange near Ferry Street. U. S. Route 4—now part of the interchange ramp system—will eventually be rerouted through this interchange. Entrance and exit ramps, not affected by the future relocation, will be graded, paved and drained. But the ramps that are dependent on the future work will be graded and drained only.

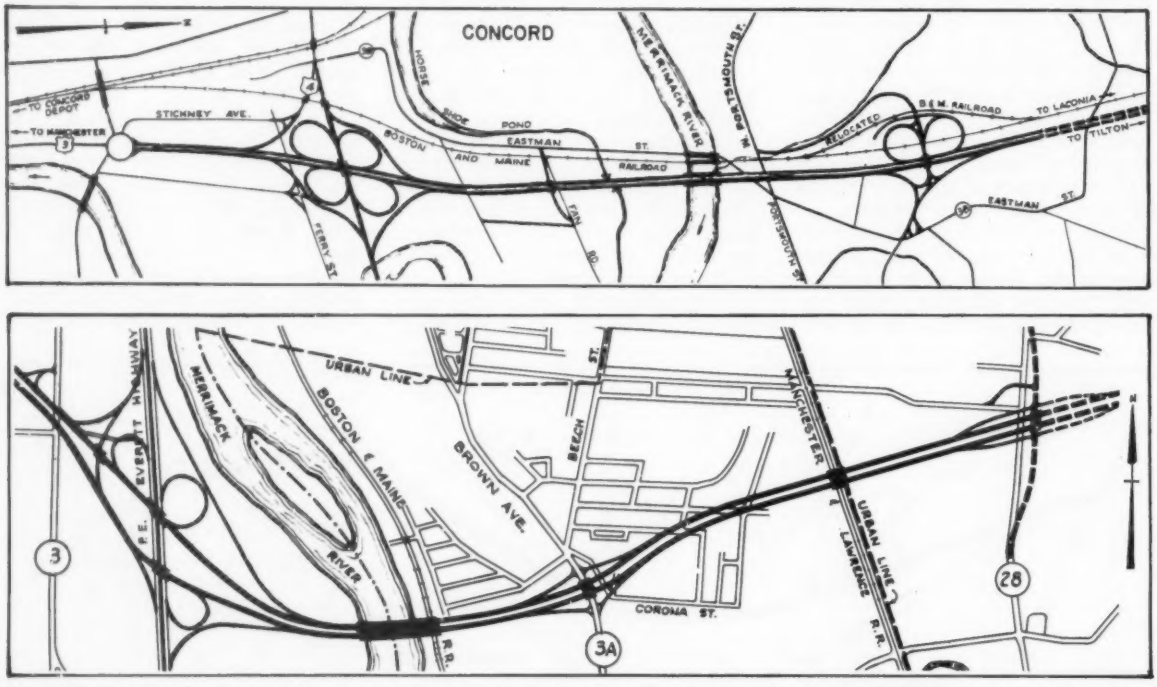
The relocation of Fan Road saves some private housing and presents a better angle of approach for carrying it over the Interstate route.

Over in East Concord the relocation problems are more involved. In fact, the local street affected—West Portsmouth Street—becomes part of the interchange. Paralleling the new construction, this two-lane street curves into the interchange and goes over the Interstate highway to join existing streets on the east side. This 4,000-ft. relocation provides access to a number of residential properties in the area. Other factors that enter into the design of the interchange are: 1) the relocation of a Boston and Maine Railroad track, and 2) the construction of a short access road to a foundry plant that otherwise would be isolated.

The Merrimack River Bridge, being the most significant structure along the section, was planned as a separate construction contract. Continuous plate girders supporting floor beams and stringers carry the 32-ft. wide roadways across the river for about 500 feet on two separate bridges. Abutments on the ends are massive single structures supported on piles driven to bedrock. The two south piers are supported on piles, while the north piers rest on footings on rock. The reinforced concrete piers are tapered along the leading and trailing edges to offer less resistance to ice and water.

The bridge decks—about 25 feet above normal water level—are constructed of reinforced concrete 6 3/4 inches thick and surfaced with two inches of bituminous concrete.

The two bridge superstructures spanning the river are, with a few exceptions, similar. The major difference is a sidewalk incorporated in the structure carrying northbound traffic. Starting at Fan Road in Concord, this five-ft. wide sidewalk extends across the river all the way into East Concord. On the superstructure of the bridge, a five-ft. wire fence, in addition to the normal steel guard rail, separates the walk from the traffic lanes. On the outboard side, a sidewalk type steel handrail is provided. The addition of the walk accounts for several structural dissimilarities . . . one of



● **NEW HIGHWAY between Concord and East Concord, top, is relatively short but highly complicated. Manchester Urban Connection, bottom, is nearing completion of the design stage. Estimated construction cost of this project is $5,500,000.**

the main girders carrying the northbound bridge deck is heavier than the other to withstand the extra sidewalk loads . . . and the center to center spacing of the girders is larger than that of the southbound roadway bridge.

Manchester Connection

A third section of the over-all program for which design is nearing completion, the Manchester Urban Connection is a part of a by-pass route around the city of Manchester, which also links Interstate Route 93 to the F. E. Everett Toll Highway. Totaling about 2.25 miles in length, the road is divided into three construction contracts to facilitate bidding: 1) From a point west of the Toll Road east to the Merrimack River; 2) the two separate bridge structures over the river; and 3) the eastward continuation from the river to State Route 28. The estimated construction cost of this project is $5,500,000.

Other than in a few general aspects, the Urban Connection has little similarity to the previous projects. Roadways are being designed for a maximum of 60 mph, the maximum gradient is 2.8 percent and the maximum curvature four degrees.

Interchanges are numerous, however. A full interchange is to be provided at the junction of the F. E. Everett Toll Highway. On the east side of the Merrimack River, the new route is connected to Route 3A by a diamond pattern interchange. And at its terminus at Route 28, an interchange of similar design is planned.

Some intermediate streets being blocked by the Urban Connection are rerouted on new marginal roads. President Road, for example, is to become a collecting thoroughfare for other streets. Extended parallel to the highway, it is diverted to follow railroad trackage under a bridge, connecting to existing streets on the south side.

Steel bridge structures account for a substantial part of the estimated $5,500,000 construction cost. At the F. E. Everett Interchange, two relatively widely separated structures carry westbound and eastbound traffic over the toll highway. A third, carrying the westbound lanes over Ramp "D", has three continuous spans, the longest of which is 61 feet.

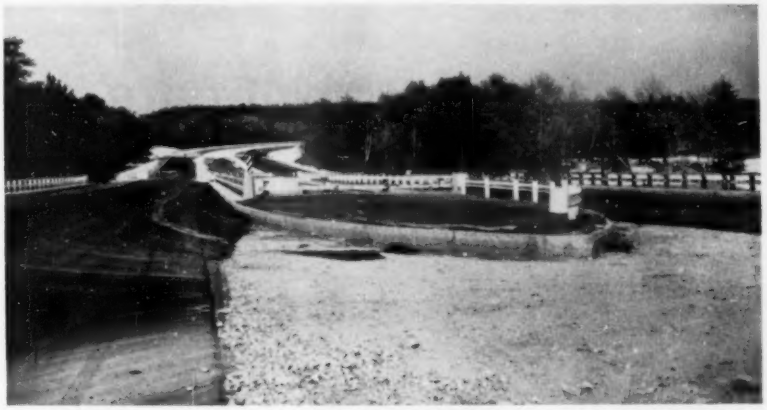
The two main bridge structures are of two-span design totaling 156 and 170 feet in length respectively. The abutments are set back from the roadway and the wingwalls faced with granite. This arrangement eliminates two approach spans that otherwise would be necessary.

Soil conditions require a variety of foundations. Those supporting the bridge carrying westbound traffic are on piles driven 35 to 50 feet to rock, while the eastbound structure rests on footings on rock.

The crossing over the Merrimack River in this project consists of two separate structures, each 918 feet between abutments, with 30-ft. roadways. The superstructure, which also spans the main line of the Boston and Maine Railroad, is made up of seven-ft. deep welded plate girder stringers supporting a 6 3/4-in. concrete deck with a 2-in. bituminous surface course. The seven spans, ranging from 112 to 180 feet in length, are arranged in two-and three-span continuous units and are supported on six pairs of reinforced concrete piers from 32 to 77 feet in height. Foundations again vary in type—some piers rest on footings on rock, some on piles extending 50 to 65 feet to rock. All abutments are also pile supported.

● **FERRY STREET** is carried over the Boston & Maine Railroad by this bridge. A space is reserved, shown at the left, for a future highway to be constructed later.

● **TURKEY POND** bridge carries a highway over a man-made channel uniting adjacent ponds. A feature of this bridge is the singular abutment and split pier design.



● **VIEW AT** roadway level of Turkey Pond bridge, showing the wide median strips between the lanes. This road is a part of extensive construction around Concord.

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NEWS BULLETINS

AMERICAN PUBLIC WORKS ASSOCIATION, 1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

1959 Public Works Congress and Equipment Show

Seattle, Wash.—Program plans are well under way, reports Seattle City Engineer Roy Morse, Chairman of the Local Committee for the 1959 Public Works Congress. Included in the technical presentations planned are forums on contractor-engineer relationships, solid wastes handling and disposal, streets and highways, water and sewage and

buildings and equipment as well as a workshop on administrative problems.

One of the featured speakers of the Congress will be Joseph Rawlinson, C.B.E., Chief Engineer, London County Council, London, England.

An important topic has been added to the annual business meeting; a panel discussion on organizing APWA Chapter programs for better service to the community. Included on the panel will be current or past chapter officers who have had important parts in successful development programs in their respective areas.

APWA Refuse Disposal Committee Meets in Washington, D. C.

Washington, D. C.—The Association's Refuse Disposal Committee met in Washington, D. C. on April 20 and 21 at the Willard Hotel. The committee session marked completion of a draft of the entire manuscript of the forthcoming manual *Municipal Refuse Disposal*, a companion volume of the recently published *Refuse Collection Practice*. The 10-man committee and its 30-member task force have prepared more than 700 pages of original manuscript and sponsored a field study of refuse production in 12 cities in 1958. Data from the latter have been incorporated into the Manual.

John Bell, Graduate Assistant, Department of Sanitary Engineering, Purdue, reported to the Committee on research on physical sampling methods and chemical analysis techniques of municipal refuse being conducted at Purdue under the general direction of Professor Don Bloodgood. The study is financed by a National Institute of Health, Public Health Service Grant.

Members of the Refuse Disposal Committee are Casimir A. Rogus, chairman; Abraham Michaels, vice-chairman; Edward R. Williams, secretary; and Theodore E. Winkler, Carl Schneider, Jean L. Vincenz, Leo Weaver, William A. Xanten, John R. Snell, and Bernard J. Geisheker.

Smallwood and Terry Receive Philadelphia Chapter Meritorious Service Award

Philadelphia, Pa. — Some 500 members and guests attending the annual meeting of the Philadelphia Chapter, April 28, 1959, witnessed

Philadelphia's Managing Director Donald C. Wagner presents meritorious service awards to Commissioner Smallwood and Mr. Terry.

the presentation of the Chapter's meritorious service award to Philadelphia's Street Commissioner David M. Smallwood and R. Brook Terry, Technical Assistant, Philadelphia Electric Company. Commissioner Smallwood was cited for his leadership and direction of Philadelphia's accelerated highway pro-

OFFICERS: Wm. D. Hurst, Winnipeg, Manitoba, Canada, *President;* Jean L. Vincenz, San Diego, Calif., *Vice President.* REGIONAL DIRECTORS: (term ending 1959) Albert G. Wyler, New Orleans, La.; Edward J. Booth, Bismarck, N. D.; Frederick Crane, Buffalo, N. Y.; (term ending 1960) Charles W. Cooke, Hartford, Conn.; R. S. Hopson, Richmond, Va.; H. H. Hester, Fort Worth, Tex.; (term ending 1961) Louis H. Moehr, Wyandotte, Mich.; John A. Morin, Oakland, Calif.; W. A. Bowes, Portland, Ore. *Immediate Past President,* Sol Ellenson, Newport News, Va. Robert D. Bugher, *Executive Director.*

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Are you making money on waste . . . or wasting money you could be making? Ask for a Hydro E-Z Pack demonstration on your toughest route–and analysis of your waste disposal operation. We'll send a free copy of "The Big Squeeze," too. (No obligation, of course.)

USERS' REPORTS

Here are excerpts from letters showing what Hydro E-Z Pack has done for a few users:

H.W.J., City Manager, Florida:
"We haul in one E-Z Pack load what formerly required seven large open truck loads."

C.J.M., Waste Paper Co., Ohio:
"Handles with ease what we formerly loaded in 32-foot van body. One E-Z Pack load equals four 14-foot stake body loads. In reducing bulk, has no competitor."

C.E.C., Disposal Co., Illinois:
"On one account for one month, we made 34 loads where we made 102 loads previously; saved on mileage, gas, oil, truck and tire wear, labor; came up with actual monthly savings of $227.20 on this one account alone. Figure one E-Z Pack replaces three other-type units."

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22,000 dwelling units
9 men—9 E-Z Packs
22,000 dwelling units
42 men—2 garbage trucks,
12 rear-loader packers.

Hydro E-Z PACK

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gram as well as other distinguished services such as implementation of programs for a new electronic traffic signal system and improved sanitation methods.

Mr. Terry was cited for his successful liaison activity between all departments of the Philadelphia Electric Company, other utility companies and municipal authorities as well as his sustained performance as a member of the Chapter's Executive Committee.

The evening's featured speaker was Francis S. Friel, President, Albright and Friel and President, American Society of Civil Engineers.

President Hurst Visits Northern California Chapter

Berkeley, Calif.—APWA President Hurst addressed the March meeting of Northern California Chapter held at Spenger's Fish Grotto in Berkeley. He emphasized that while predictions are dangerous in this rapidly changing world, public works officials should be vitally interested in the future and keep thinking and policies flexible to fit future technological advances and population requirements. Mr. Hurst asserted that "Intelligent advance planning will pay off; greater than ordinary services will be required; intelligent water conservation and waste control will be most important; transportation should change more toward mass transit; and public works officials must remain alert to changes and keep informed." He also stated that APWA members should avail themselves of services provided by the Association's headquarters' office and closed with the admonition "make and keep the Chapter strong, as strong chapters make a strong association that can be of greater service to members."

Murl Fritschle, City Manager of Pacific Grove, California, received from President Hurst a Certificate of Appreciation awarded by the APWA in recognition of that City's completion, in 1958, of ten years as a public agency member of the Association.

William J. Stevens, Personnel Director, East Bay Municipal Utility District was guest speaker. Emphasizing the employee relations aspect of public relations, Mr. Stevens stressed that public relations are becoming more and more important to public works officials. He stated, "PR basically means doing a good job and getting credit for it. PR in all its phases is important. Employees must be kept informed so they are in a position to pass along right answers and reasons when mingling in the community." Mr. Stevens also stated that "The word on what is going on must be spread to create a good corporate image" and emphasized the importance of good press relations.

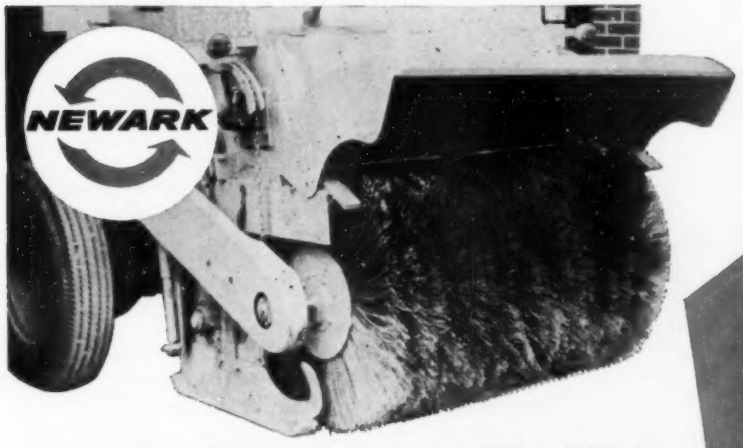
"Good PR must be something desired by the whole organization and all must do something positive about it."

Sustaining Member Number 35

Chicago, Ill.—For the third consecutive month, a sustaining member has been added to the APWA roster. Number 35 is the Hydro E-Z Pack Division of Hercules Galion Products, Inc., manufacturers of compaction type refuse collection bodies.

Garbage, Sewers, Streets Topics at Alabama Meeting

Montgomery, Ala.—A highly successful annual meeting of the Alabama Chapter was conducted in April at Montgomery, Alabama under the leadership of Chapter President W. Wilson Hill, Superintendent



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of Public Works, Auburn, and J. T. Waggoner, Commissioner of Public Improvement, Birmingham.

Municipal garbage problems were discussed by L. N. Hall, Superintendent, Sanitary and Street Departments, Albany, and W. H. Kittrell, Assistant Sanitary Engineer of the State Health Department. It was pointed out that garbage and other refuse collection and disposal in Alabama are functions performed under the police powers of the municipality in the interest of public health and welfare.

The panelists reviewed the need for basic ordinances establishing minimum garbage storing facilities on private premises, proper safeguards for hauling garbage and other refuse over public streets, controlled dumping of garbage, control over scavenging operations, control over unusual wastes such as dead animals and industrial refuse, and eliminating individual disposal. It also was pointed out that proper disposal requires two pick-ups each week and final deposition in such a manner as would prevent fly breeding, rat infestation and mosquito problems.

Panelists on municipal sewer problems were J. W. Moss, Engineer with J. B. Converse and Company of Mobile, and Professor Theodore Jaffe of the Civil Engineering School at Auburn. At the beginning of this discussion it was recognized that Alabama cities and towns act in a proprietary capacity in the maintenance and operation of municipal sewer systems and that the municipality has the legally imposed duty in such operations to use reasonable and ordinary care to prevent injury to persons and property. To insure proper performance of this duty, the panelists advocated a planned sewer maintenance program which would feature: 1) knowledge of every part of the system and up to date maps; 2) keeping records of costs, inspections and special calls; 3) dividing responsibilities for phases of the operation; 4) training sewer personnel to look for trouble spots, to safeguard against sewer damage, to prevent gas accumulations, and to know basic safety measures in sewer operation; 5) inspection at planned intervals with particular emphasis on connections, manholes and manhole covers, and observation of uses being made of sewers.

Street construction and maintenance were discussed by J. F. Tribble, Chief Materials Engineer for the State Highway Department and Professor Arthur Chase, Civil Engineering School, Alabama Polytechnic Institute. Two factors of primary importance in street construction and maintenance were emphasized: 1) A street is no better than the base under the paved surface—the base must be designed to carry the traffic loads expected over the street; 2) the foremost rule in maintenance is prompt repair—if water is allowed to get under the surface paving into the base the problem of maintenance is multiplied.

Judge Oakley W. Milton of Wetumpka gave an entertaining talk at the dinner meeting. APWA Regional Director Albert Wyler, Director of Streets of New Orleans, Louisiana and Executive Director Robert D. Bugher of Chicago were among the dinner guests.

J. T. Waggoner was elected Chapter President for 1959-1960 to succeed W. Wilson Hill. L. B. Green, Superintendent of Sanitation of Montgomery was elected Vice-President and Rex McGinnis, Superintendent of Streets of Birmingham was re-elected Secretary-Treasurer. Elected to the Board of Directors were Mayor V. H. Albright of Haleyville and Mayor Felix Erwin of Tarrant.

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treated water
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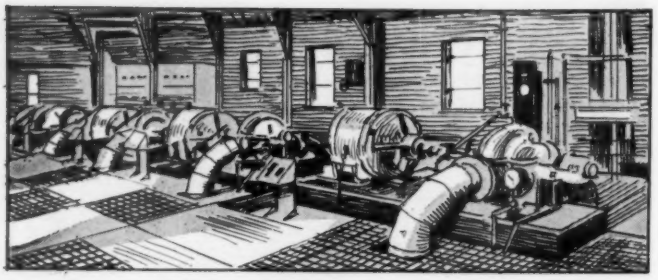
THE WATER WORKS DIGEST



Prepared by **ALVIN R. JACOBSON, Ph. D.**

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

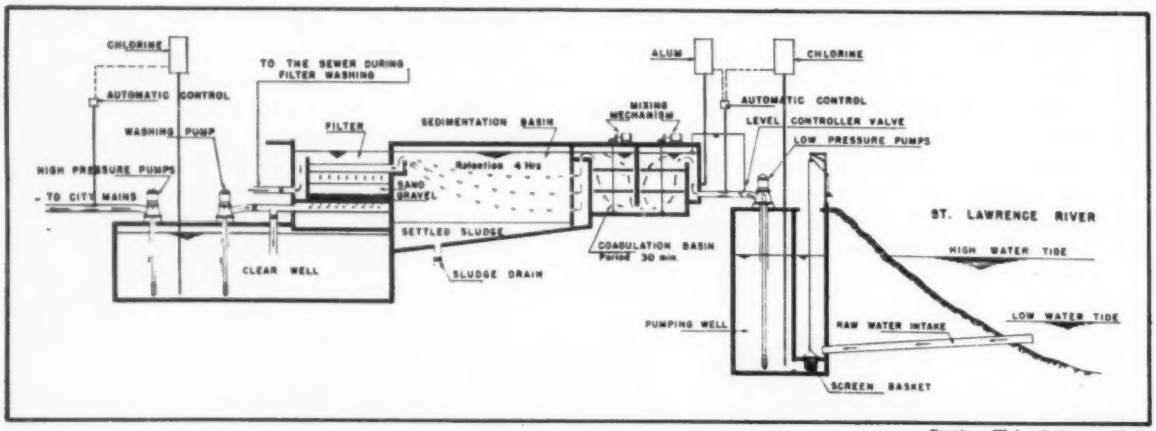
Canadian Filtration Plant

The community of St. Romuald d'Etchemin, Quebec, has a new water treatment plant with a nominal capacity of 1 mgd which can be expanded to 4 mgd to meet the population increase expected by 1975. The plant intake is from the St. Lawrence River, the raw water flowing by gravity into a pumping well where basket type screens and a special hand-operated lifting device has been provided to retain sea hay, fish and other objectionable materials. To overcome needle ice and other obstructions at the mouth of the river intake pipes, an arrangement of connections and valves in the valve room, ahead of the pumping well, has been devised to permit emptying the coagulating basins or one of the settling basins which cause a violent backwash sufficient to clear the mouth of the pipe of any ice or other obstruction. The two coagulating basins, built in series, provide a 30-minute retention period while the three sedimentation basins were designed for a detention period of about 4 hours. The three filters are provided with a surface wash system utilizing two 3-inch copper mains, suspended to the wash troughs, with ¾-inch copper laterals having 3/32-in. orifices in pairs, on 6-in. centers. A 100-KW generator has been provided as an emergency power unit, operated by a standby diesel motor that is started by a storage battery. Both pre- and post-chlorination is used. The total cost of the plant was $303,915.58.

"St. Romuald, Que. Filtration Plant." By Marc Gilbert, M. Sc., *Water and Sewage Works*, April, 1959.

Meter Readers Take to the Air

A change in tools reduced meter-reading time from 14 days to 10 days in Monroe, N. C. Complete re-routing and the adoption of a visual filing card system should trim two more days from the monthly meter reading schedule. On April 1, 1958, the radio method of meter reading was adopted. In this method, the two meter readers work together to read about 4,000 water meters and the same number of electric meters each month. Each man carries a portable Motorola walkie-talkie type radio—but no books or other equipment. Normally the men use earphones similar to a hearing aid and noise cancelling mikes. The base station is equipped with a desk mike that can be operated by hand at the mike or by a foot pedal whenever the billing clerk desires to contact the meter readers. The meter books have been replaced by a Remington Rand Kardex system capable of holding eight years of records for water, electric and gas use. The readers work together, one reading the electric meter, the other the water meter. The billing clerk records the readings, checks for abnormal use, and makes the computations while the readers proceed to the next location. Any unusual readings can be reviewed immediately by radioing back to the readers for an on-the-spot check. In the near future the town of Monroe, with a population of 12,500, will have a natural gas system. The same two men will read the gas meters on their regular rounds and



Courtesy Water & Sewage Works

● **WATER filtration plant at St. Romauld draws from St. Lawrence River. Designed for 1 mgd, it is expandible to 4 mgd.**

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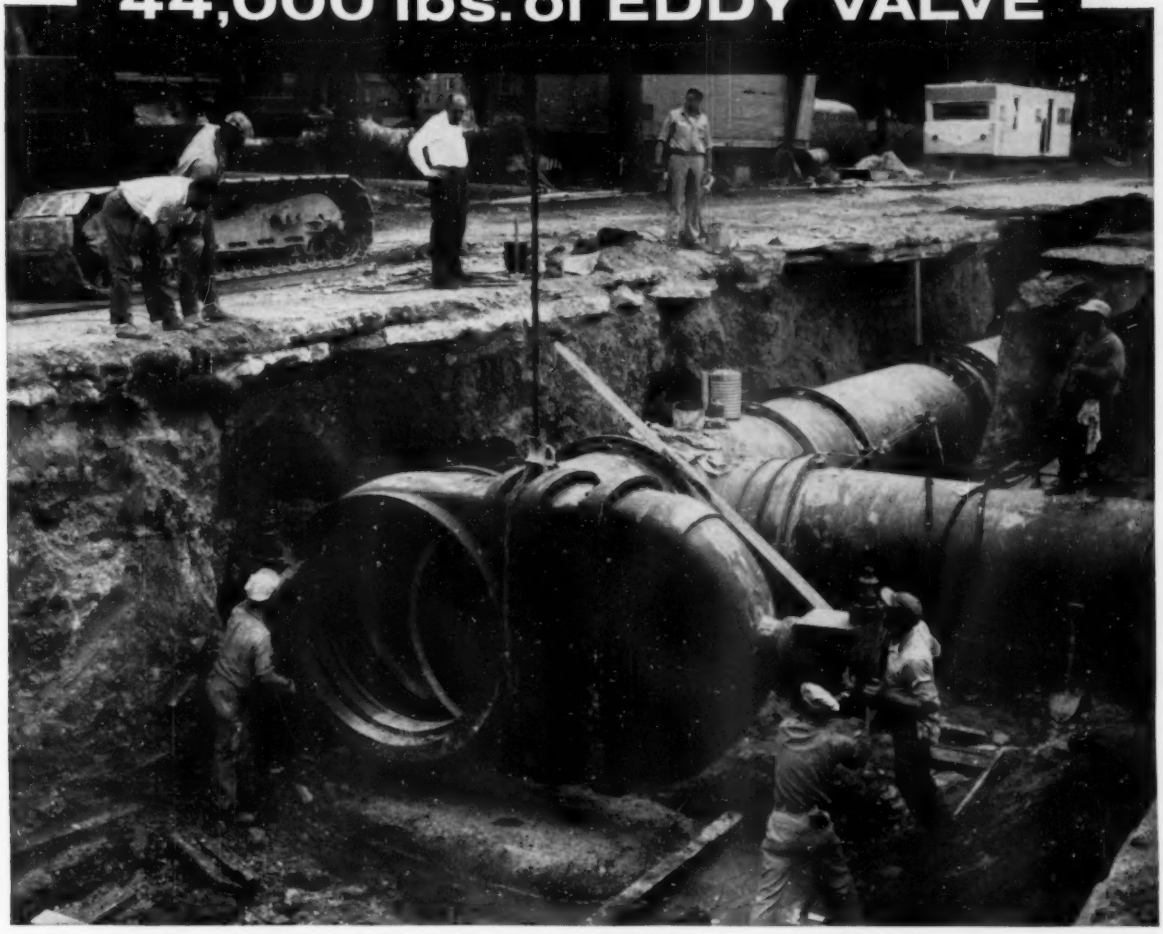
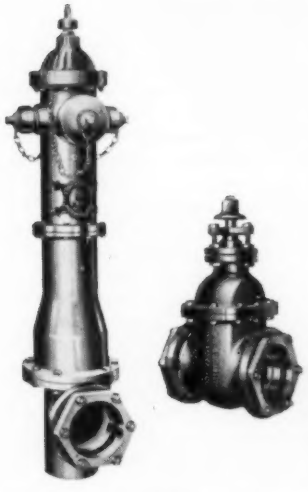
44,000 lbs. of EDDY VALVE



Giant 60" Eddy Valves for Buffalo, New York



As part of a major waterworks improvement program, three 60" and fourteen 48" 300 lb. test IBBM EDDY valves have been installed by Fago Bros., Contractors, for Buffalo, New York. Each 60" valve weighs 44,000 pounds; each 48", 21,500 lbs. These are BIG valves...and do a BIG job.

EDDY's ability to supply valves of this size and ruggedness is the result of engineering skill and long experience in meeting almost every service requirement. EDDY manufactures a full line of valves for underground or special service to answer almost any specification for iron body valves.

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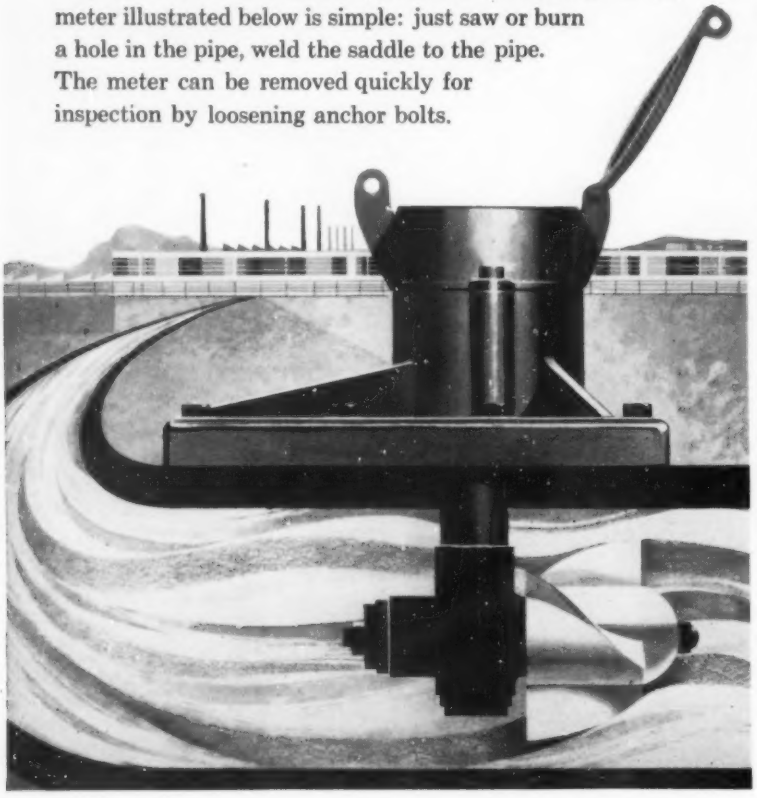

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these will be billed at the same time as the water and electricity bills are sent out. The advantages of this system are: Saving of time; elimination of special check readings and accompanying labor and transportation cost; immediate knowledge of abnormal readings which can be checked on the spot; increased billing speed, and an end to wet and smudged meter book pages.

"Meter Readers Take To The Air." By J. E. Hinkel. *The American City*, April 1959.

Effect of Nuclear Attack

An examination of the literature on the measurement and control of radioactive materials in water attests to the interest of the workers in the water utility field in nuclear developments. This examination also reveals that much emphasis has been placed on past and present problems, but hazards that may occur in the future have been relatively neglected. Maximum permissible concentrations (MPC) of radioisotopes for continuous lifelong intake in time of peace and radioassay techniques for the measurement of radioisotopes at levels below these concentrations have been developed. These techniques have protected workers at or near atomic-energy establishments and the public at large. With the advent of nuclear research and the development of the power reactor, the possibility of accidental short-term intake of relatively large amounts of radioisotopes had to be considered. MPC levels have been proposed on single emergency exposures. The next step, the evaluation of MPC of radioisotopes in drinking water following test atomic explosions, is still in the process of formulation. The problem has been made more difficult as a result of the concentration of radioactivity which appeared in precipitation and in drinking water reservoirs following recent nuclear weapons tests; in certain instances the radioactivity exceeded published criteria by as much as several hundred times. The problem of establishing reliable MPC standards applicable to nuclear warfare is closely tied to the problems raised by fallout from nuclear bomb tests. Providing potable water as a vital resource following a nuclear attack will require the formulation of rational criteria for MPC of radioisotopes. The author has outlined the concepts used in making such a formulation. Definite criteria have been given by

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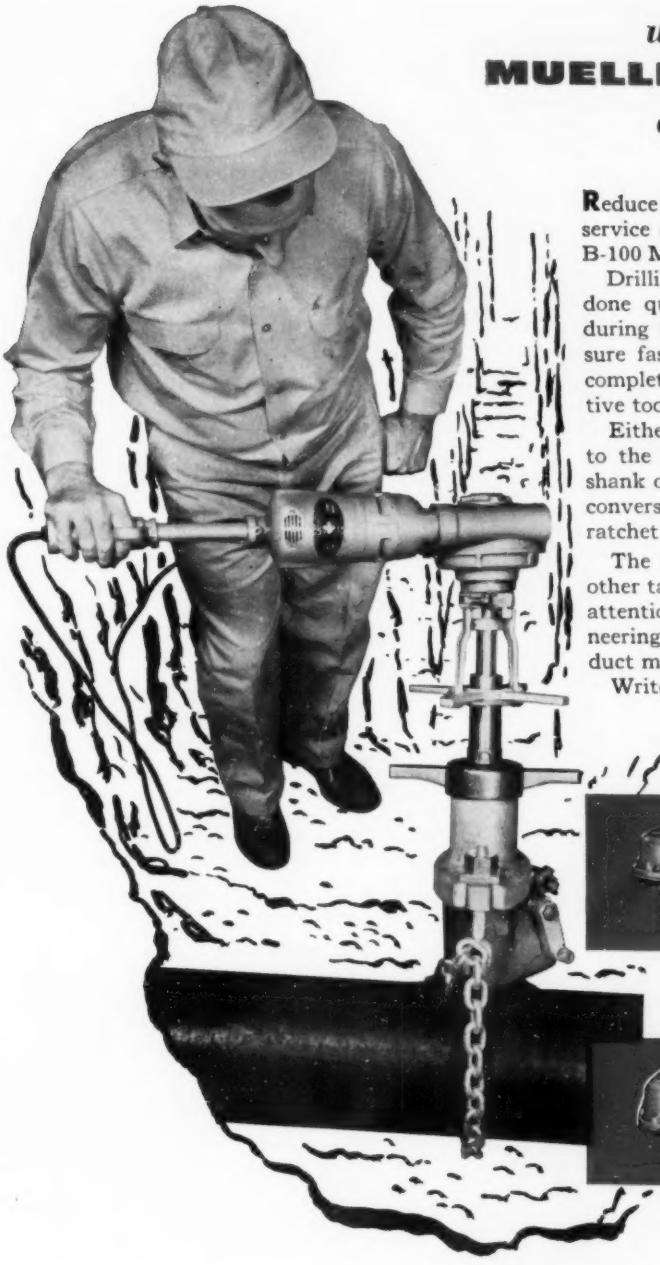

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Reduce time and effort to a minimum on all of your service connection jobs by using the new Mueller B-100 Machine and Air or Electric Power Operator.

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Either type of power operator attaches directly to the top of the boring bar *and* to the square shank on the top of the feed yoke. No adapters or conversion parts are needed — simply lift off the ratchet handle. Both power units are reversible.

The modern, new "B-100" is far ahead of any other tapping machine available. It is typical of the attention to detail in research, design and engineering that becomes a part of every Mueller product manufactured for the water industry.

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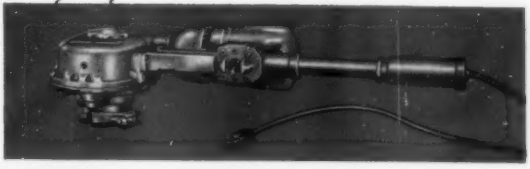

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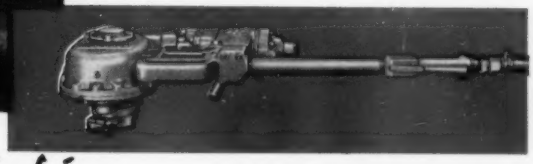

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other authorities, but refinement is desirable. The application of the criteria established would involve a preliminary specific radioassay of the water. This article has described some of the specific areas in which further research is needed.

"Concepts in Determining Potability of Water After Nuclear Attack." By Gerhard Klein. *Jour. A.W.W.A.*, April, 1959.

Domestic Reuse of Waste Water

On the basis of the limited experience at Lyndon and Chanute, Kansas, and the much greater experience of cities in treating heavily polluted water, some reuse of waste water by cities is possible; and the use can be undertaken safely from a health standpoint. The author believes that the public health profession holds the key to the question of water reuse and must conduct the research and studies necessary to provide the answers that were not available in the fall of 1956 when the two Kansas cities had to turn to water reuse during a serious drought. In each of the communities the effluent from the secondary sewage treatment plant, consisting of standard trickling filters, was chlorinated heavily to destroy coliform organisms, followed by long periods of storage in the stream bed. At Lyndon water was stored at an estimated period of from a few to 60 days while storage for about 20 days was provided at Chanute. Viral studies were conducted by the Robert A. Taft Sanitary Engineering Center. While two positive virus isolations were made from the treated sewage at Chanute, some 38 other samples were negative, including all the raw and treated water. Although the bacteriological and biological quality was entirely satisfactory, there was a definite deterioration in the chemical quality at both plants. The deterioration was more pronounced at Chanute because the water was reused many times, estimates varied from 8 to 15 times. At Chanute, the chlorides increased from 190 to 670 mg/L. When the raw water was at its worst, it contained 17 mg/L of nitrogen, 5.8 mg/L of alkyl benzene sulfonate (detergents) and had a BOD of 13 mg/L. Other chemical and physical characteristics were also much higher indicating deterioration of water quality. The author concludes that before waste water is used for domestic purposes, all other possible sources of supply should be exhausted. In addition, industries and users should have adopted water conservation practices which include cooling towers and the use of treated waste water for processes which do not require the higher quality water.

"The Reuse of Treated Waste Water for Domestic Purposes." By D. W. Metzler. PUBLIC WORKS, May, 1959.

Water Supplies During Drouth

A great emergency occurred during 1957, when the northeastern portion of the United States experienced an extended dry period which caused much anxiety to many water works officials and a considerable loss to water utilities, farmers and others. Connecticut was among the states that were seriously affected. The author, who is the Principal Sanitary Engineer of the State Department of Health, Connecticut, has written this article to show some of the problems which plagued many of the water works men during this emergency. The data should help in providing experience to eliminate repetition of conditions over which man has some control and should result in planning to avoid future emergencies of this na-

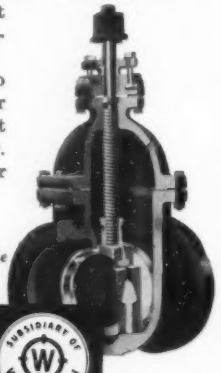
PEOPLE AND WATER

Two things mostly have brought about America's present water problem: Increasing population and progress of human civilization. Both are cumulative and therefore will surely produce greater water problems in the future.

Ancient Man simply knelt beside a stream and drank water like any other animal. But for one human who existed in the time of Moses, there now are millions. Today, the fastest growing population in the world is in America. It is estimated the U. S. population by 1975 will be 227 million. Present water consumption is 140 gallons per capita per day and steadily increasing. The Earth's total volume of water is abundant. Man's problem is to capture and purify enough of it at one time during the hydrologic cycle to serve his increasing needs due to the progress of civilization.

Water is the natural resource most essential to human survival, yet public support of modern water development and research has been lacking. Don't let your water works superintendent do all the worrying. He has big plans for the future. But, he needs your help and encouragement.

This Series is an attempt to put into words some appreciation of the water works men of the United States.



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WATER METERS

Nationally known for low Maintenance

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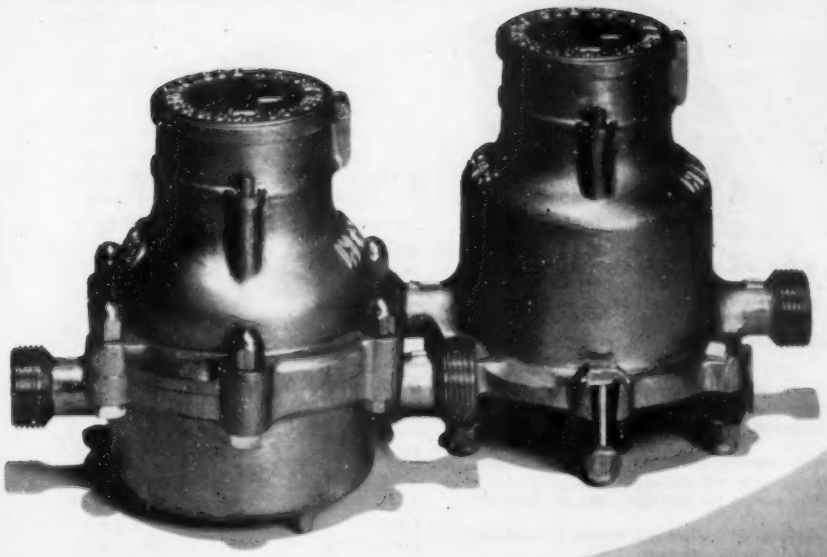

HERSEY 1859 1959 100 YEARS OF PROGRESS

HERSEY MANUFACTURING COMPANY

(Established 1859)

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"You can't buy a better Water Meter than HERSEY."

Luxurious hotel protects the masonry of its reservoirs from leaking!

THORO System Materials employed for their sealing and waterproofing qualities

Workmen applying Thoroseal to heavy masonry structure required 30,360 lbs. of Thoroseal

Subterranean vaults house fuel oil and fresh water supply for Habana Hilton

Poured concrete rooms, two and three floors below basement level, were designed to house supplies of fresh water and fuel oil in the operation of the Habana Hilton in Cuba.

Although the masonry in these storage rooms was structurally sound, it was equally imperative that they be leakproof.

The THORO System materials were employed to seal the concrete structure of these unique rooms against leakage.

WATERPLUG, famous for its ability to stop leaks instantly, was applied to the joints where walls, floor and ceiling met and to anchor pipe and conduit fixtures.

THORITE, a twenty-minute set patching compound, was troweled into the honeycombing of the masonry.

THOROSET ingredient for hardening and waterproofing concrete was used in the mixture of a cement compound for trowel-coating over all surfaces.

THOROSEAL, applied in two heavy brush coats, sealed the masonry from all possible leakage.

THOROBOND, applied to the extra smooth sections of the poured masonry, made it possible to bond both THOROSET and THOROSEAL to the surface.

P & W Floor Hardener gave floors extremely hard wearing surface.

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ture. In addition to citing problems which plagued individual water works, the author has summarized the lessons learned from these emergency situations throughout the state. Some of these lessons learned are that: 1) Officials of the state health department can frequently be of considerable assistance to the individual water works; 2) an effort should be made by adjacent utilities to be of mutual aid to each other; 3) the hydraulics of the distribution system should be studied, and a thorough knowledge of weakness should be acquired; 4) similarly, the hydraulics of the collecting system should be known; 5) possible emergency equipment should be checked constantly; and 6) valves should be checked.

"Public Water Supplies of Connecticut During the 1957 Drouth." By F. O. A. Almquist. *Jour. New England Water Works Ass'n.*, March, 1959.

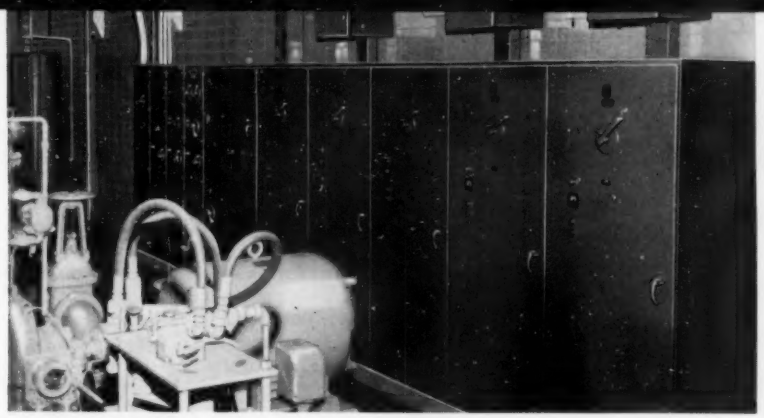
Dual System Problems

Iron Mountain, Mich., has two sources of water: Lake Antoine, one mile in diameter and 18 to 20 feet deep with a bathing beach on its shores; and the other, a 2300-ft. deep abandoned mine shaft. These two sources pose four technical water works problems: Tepid water temperature; objectionable tastes and odors; excessive hardness and "free" recreational use of the intake source. These problems are being solved by modern water treatment methods including: Break-point chlorination, periodic main flushing, softening, alternate seasonal transfer from one supply to the other, and supplementary use of activated carbon. Although the quality of water has always been good from a bacterial standpoint, it was felt that breakpoint chlorination would be an improvement as it would greatly increase the factor of safety from a sanitary standpoint with as high as 7,000 persons using the shore of Lake Antoine as a public bathing beach. At present, from 0.5 to 0.7 ppm free chlorine is carried at the point of application, and from 0.40 to 0.50 ppm free residual is maintained on top of the filters. The new method of flushing the mains consists of opening the hydrants, permitting the water to flow until it runs clear, then the worker takes a flash chlorine residual and records it as the first chlorine reading. If the color development of the free chlorine residual is below 85 percent, he continues flushing until the necessary percentage is reached.

"AS SPECIFIED" Lake Forest's New Water Treatment and Pumping Station Equipped with Cutler-Hammer Unitrol

LAKE FOREST, ILLINOIS WATER TREATMENT & PUMPING STATION

Capacity: 7,200,000 gallons per day
Superintendent: G. L. Watson
Resident Engineer: H. R. Von Huben
Consulting & Design Engineers: Greeley & Hansen, Engineers
Electrical Contractor: Art Electric Co., Inc.



CONTROL CENTER #1 Compact grouping of the high lift pump control, main circuit breaker, and pump room auxiliaries Unitrol section cut installation costs . . . promotes efficient, trouble-free operation and maintenance.

CONTROL CENTER #2 Front-and-back Unitrol Construction places the control for the stirring machines, ventilation, de-watering pumps and feeder circuit breaker in the main lobby; and the controls for the boiler, air-compressor, and wash water pump in the adjacent boiler room.

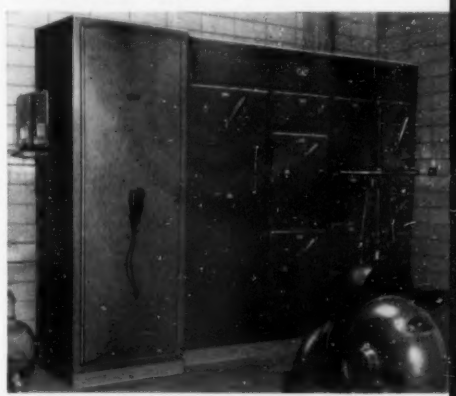
Men who know choose Cutler-Hammer Unitrol

Unitrol simplifies plant design, costs less to install. Exact dimension and construction details are known, eliminating false starts in plant layout and costly on-the-job revisions . . . no special floor or wall preparations are required . . . no hidden installation extras.

Unitrol is *first* in performance and dependability. Extra-life vertical contacts stay clean and trouble-free. Adjustable overload relays work every motor up to rated capacity safely without needless pumping interruptions caused by nuisance tripping. Full three-phase, 3-coil overload relays easily included whenever desired.

Unitrol Control Centers never become "orphans." Complete factory records are maintained so that whenever pumping facilities are expanded the Unitrol Control Center "grows" without having to re-engineer the total job. This feature alone has saved thousands of dollars for many rapidly growing municipalities.

Be sure you have all the latest facts on Cutler-Hammer Unitrol . . . its many extra features assure you better plant design, important installation savings, and dependable trouble-free operation. Write now for the new descriptive bulletin EN142-L204. Cutler-Hammer Inc., Milwaukee 1, Wisconsin.



REMOTE PUMPING STATION Earlier improvement to Lake Forest's water system included the construction of a 2,000,000 gallon underground tank and remote controlled pumping station. Here, too, Cutler-Hammer Unitrol is used to control the electric motor driven equipment.

CUTLER-HAMMER CONTROL

CUTLER-HAMMER

Cutler-Hammer Inc., Milwaukee, Wis. • *Division:* **Airborne Instruments Laboratory.** • *Subsidiary:* **Cutler-Hammer International, C. A.**

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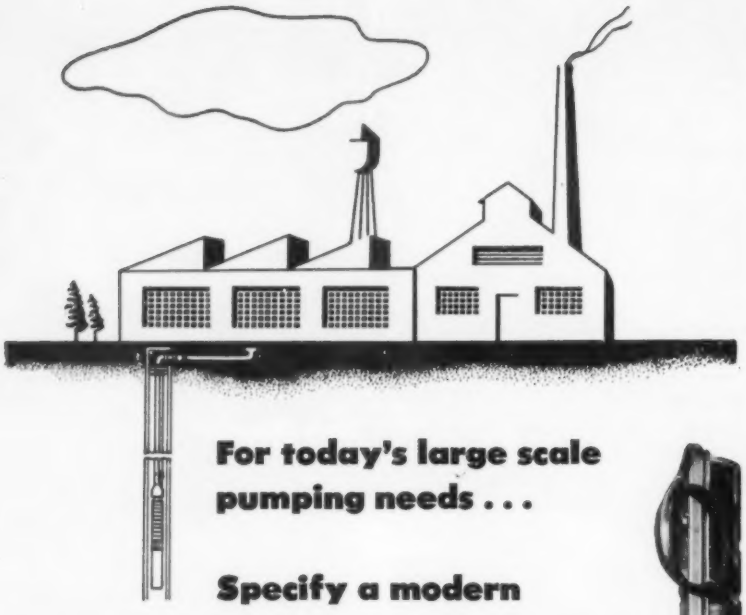

For today's large scale pumping needs . . .

Specify a modern

SUMO SUBMERSIBLE PUMP

Here is the latest thing in large scale pumping from deep wells — the Sumo Submersible. The entire unit, motor and pump, operates *inside* the well where it is protected against damage from floods, freezing or tampering. No pump house is needed.

Proved and tested by almost half a century of service in installations all over the world, Sumo Submersibles will give years of troublefree, maintenance-free service. Capacities range up to 2000 gpm. Power ratings range from 1/3 hp to 120 hp.

What's more, installation is exceedingly simple. The unit is simply attached to the end of the discharge pipe and lowered into the well casing. There are no drive shafts or bearings or alignment problems to give trouble. And, because the pump is coupled directly to the motor, more efficient use of power is obtained.

Sumo offers technical advice and assistance in selecting and applying submersible pumps to your needs. There's no obligation.

BULLETIN B-1000

has full information on Sumo high-capacity pumps. Call or write for your copy. Also request data on Sumo extra high capacity 120 hp units.

SUMO SUBMERSIBLE DRAINER PUMPS

for pumping water containing high percentages of solids. Write BULLETIN B-1100 for details on these rugged, heavy duty pumps designed for drainage, flooding or general service pumping.

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The Complete Line from 1/3 hp to 120 hp

Taste and odor conditions generally disappear immediately after such a flushing program.

"Dual System Poses Problems—Modern Practices Solve Them." By Anton Kovochich. *Water Works Engineering*, April, 1959.

Radioactive Contamination

Ionizing radiation of all types is harmful to living tissue. Because of this, and in the absence of a thorough understanding of the ultimate detrimental effects, the National Academy of Sciences and the Medical Research Council, Great Britain, have suggested that all possible efforts be made to keep the levels of radiation as low as possible. In coping with the problem of radioactive contamination of water, it is important to locate potential sources of radioactivity both peaceful and otherwise. The deposition of debris from nuclear devices is world-wide, but it varies in intensity depending on the type of device tested, the location, height, and topography of the detonation site, and the prevailing weather conditions. AEC, usually in conjunction with other federal and foreign agencies, operates various networks to define the fallout problem. The USPHS Robert A. Taft Sanitary Engineering Center, Cincinnati, in cooperation with state and municipal agencies, operates three national networks. For five successive years (as of March, 1958) measurements of the gross beta radioactivity of precipitation (rain and snow) and of atmospheric particulates have continued at Cincinnati. The gross beta radioactivity has been shown in graph-form for each week for the year 1957. Other graphs indicate the monthly (1957) and annual deposition of long-lived fallout, 1953-1957; monthly deposition of radioactive matter, 1957; and decontamination of rain by natural agents.

"Radioactive Contamination of the Environment in the Cincinnati Area." By L. R. Setter and H. H. Russell. *Jour. A.W.W.A.*, April, 1959.

Other Articles

"**Radiological Health** Training for Supply and Pollution Control Personnel." A discussion of the short-term, specialized, technical training courses conducted by the Robert A. Taft Sanitary Engineering Center, Cincinnati, for water supply and pollution control personnel. By D. W. Moeller, D. A. Pecsok and H. P. Kramer. Jour. A.W.W.A., April, 1959.

"Assembly and Operation of a **Low-Level Counting Facility.**" Determination

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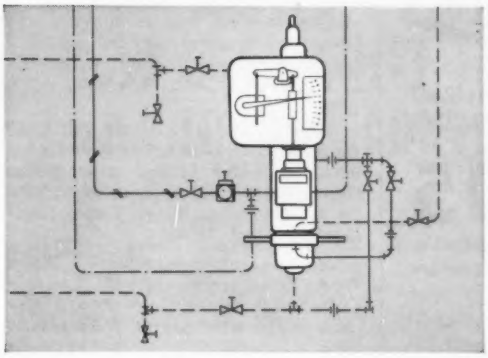
is a Pfaudler Permutit program providing a modern, imaginative approach — plus the specialized materials and equipment — for handling and processing and controlling more profitably the liquids and gases which are the lifeblood of our manufacturing economy.



FLUIDICS AT WORK

New pneumatic transmission system more accurate, more dependable

The diagram shows a typical setup for the new Simplex system for transmitting rate of flow and loss of head to a receiver.

Rate of Flow

The new Type PN transmitter combines the exceptional accuracy and range of a differential converter operated by a mercury float with the traditional dependability of pneumatic transmission.

The transmitter consists of a differential converter which extracts the square root flow function from a primary and then positions a pneumatic motion transmitter. The transmitter produces a pneumatic 3 to 15 psig linear signal. A booster pitot diaphragm in the motion transmitter insures a low lag coefficient and fast transmission.

Besides getting a linear signal without using supplementary pneumatic relays, this new unit gives you point accuracy over wide ranges of flow with minimum differentials. The booster permits accurate transmission over long distances with minimum lag.

Loss of Head

A Type TD transmitter gives accurate readings to within $\pm 1\%$. It uses no stuffing boxes or relay valves, so both installation and maintenance are simple and economical.

Connected to Simplex Pneumatic Gauges, this new system should give long years of accurate, dependable, trouble-free service.

SIMPLEX®

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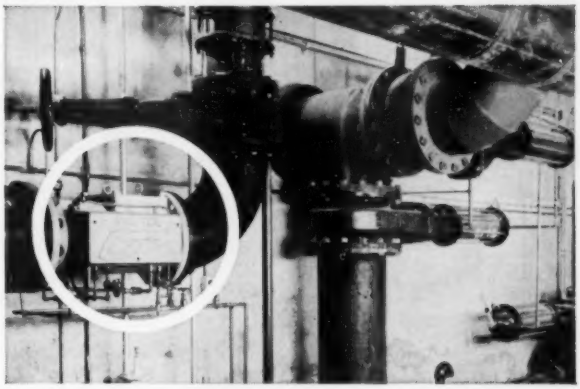
Specialists in FLUIDICS . . . the science of fluid processes



FLUIDICS AT WORK

Modulair Flow Controller installs as easily as a piece of pipe

So simple is this new pneumatic rate-of-flow controller, you can install it in about the time it takes to install a piece of pipe.

The differential producer and the modulator lie in a single housing. The actuator is entirely enclosed in a case which mounts directly on the housing.

Result: No complicated piping or drain system to install and maintain.

For a bulletin giving complete specs and performance data, write to our Simplex Division, Dept. PW-69, Lancaster, Pennsylvania. Ask for Bulletin 951.

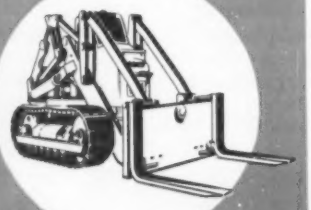
Fast, dependable delivery insured by new plant

This is the new $2,000,000 home of our Simplex Division . . . an ultra-modern plant designed from front to back to give you fast, dependable service on valves and meters. New manufacturing techniques, updated assembly lines and ample manufacturing capacity and a complete staff of skilled workers have all been planned around the single objective of getting your orders to you on time and built to your exact specifications.

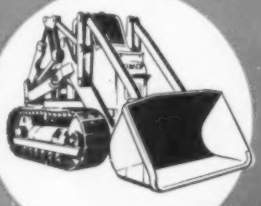
THE BIG E Announces
NEW MODEL DESIGNATION
FOR SPECIALIZED CRAWLER EQUIPMENT

EIMCO 105
This is the basic **Tractor** available with **Dozer, Excavator** or **Excavator-Dozer** Attachments.

EIMCO 115
New number designation for Eimco's rugged **Steel Mill Excavator.** Extra-Strong, for use in slag pits and other steel mill areas.



EIMCO 125
This is model number for the **Front End Loader and Fork Lift** . . . fast, maneuverable, strong.



EIMCO 135
Specify this number for **Eimco's Steel Mill Front End Loader** . . . specially engineered and proven in use in steel mills throughout the world!

Every Eimco Crawler Unit gives you greater maneuverability, greater production and work-output, greater economy . . . is engineered for service to your industry to save you time and maintenance costs.

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Write for facts and qualified engineering assistance on Eimco . . . the MODERN Crawler Equipment.

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BRANCHES AND DEALERS IN PRINCIPAL CITIES THROUGHOUT THE WORLD

and identification of environmental radionuclides have been extended to very low levels at the Robert A. Taft Sanitary Engineering Center, USPHS, Cincinnati, Ohio. By B. M. Branson, G. R. Hagee, A. S. Goldin, G. J. Karches and C. P. Straub. Jl. A.W.W.A., April, 1959.

"**Job Evaluation** of Water and Sewage Treatment Plants in Florida." A step-by-step job evaluation study of 9 sewage and three water treatment plants by the point-rating method. By L. J. Turvaville. Jour. A.W.W.A., April, 1959.

"Chemicals Replace Scythe and Axe." **Chemical control of brush** growths has been successful around metropolitan Hartford's two water supply reservoirs. By A. W. Paine. Water Works Engineering, April, 1959.

"Management Symposium — **Water Works Management**—Part II". The second set of three slightly condensed versions of the nine papers presented on various aspects of water works management at the Penna. Water Works Ass'n. The program had been arranged by John Murdock, Jr., President of the Association. Water and Sewage Works, April, 1959.

"Safety in **Chlorine Handling.**" This fourth of a series of articles on chlorination practices is devoted to the emergency aspects of chlorine use. By Edmund J. Laubusch. Water and Sewage Works, April, 1959.

"Solving the Water and Sewerage Problems of **County Urbanization.**" How Alameda County, California is attempting to solve its water and sewerage problems. By H. G. Crowle. Public Works, May, 1959.

"Two Centuries of **Water Works Progress**" at Bethlehem, Pennsylvania. By H. R. Frantz. Public Works, May, 1959.

• • •

Women as Meter Checkers

The hiring of women as meter checkers has tightened up automobile parking in Beverly Hills, Calif. The four women are employees of the city finance department and were selected from 21 applicants. Two women patrol the central business area on foot while the other two patrol outlying areas on three-wheeled motor scooters. The meter checker fills out a punched card in duplicate with data on license, make of car, time, date and meter number and location. The duplicate is left under the windshield wiper and can be mailed in to the city finance department with the check to pay the $2 fine. The original is returned immediately to the finance department. Punched cards are matched within 48 hrs. so that notices for unpaid fines can be turned over to the municipal court for collection.

PEAK POWER OUTPUT FOR HEAVY-DUTY EQUIPMENT...

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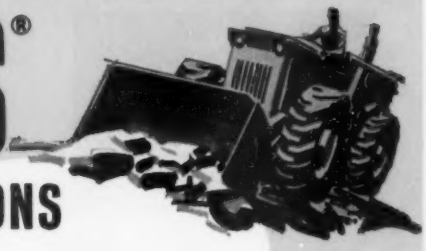


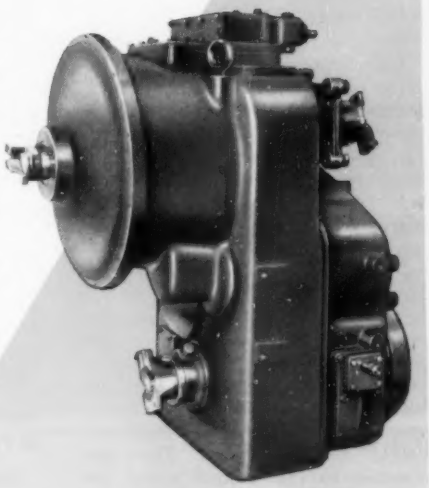
POWER SHIFT TRANSMISSIONS and TORQUE CONVERTERS

Rockwell-Standard's Hydra-Drives units make hard work easy for heavy-duty equipment. The result . . . smooth, efficient, economical operation. A torque converter and 4-speed transmission in one compact package, the Hydra-Drives Power Shift Transmissions have been proved in hundreds of vehicles. They eliminate engine lugging and heavy shock loads. A 3-to-1 torque multiplication makes starting fast and effortless—even with heaviest loads.

Just a flip of the operator's lever accomplishes power shifts without interruption of the power flow. Automatic features of the converter and ease of power shifting simplifies operator training and lengthens vehicle life.

With four speeds forward and reverse, the Hydra-Drives Power Shift Transmissions are ideally suited for vehicles which must travel in both directions during a normal work cycle.

Hydra-Drives Torque Converters are the simplest, most efficient made. They can be matched with any transmission for easier, more efficient operation.



HYDRA-DRIVES BDB Transmission

- Four speeds forward and reverse.
- Full power shifting.
- For equipment up to 175 h.p.

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- Four speeds forward and reverse.
- Power shift in each range both forward and reverse.
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HYDRA-DRIVES Torque Converter

- 3-to-1 torque multiplication.
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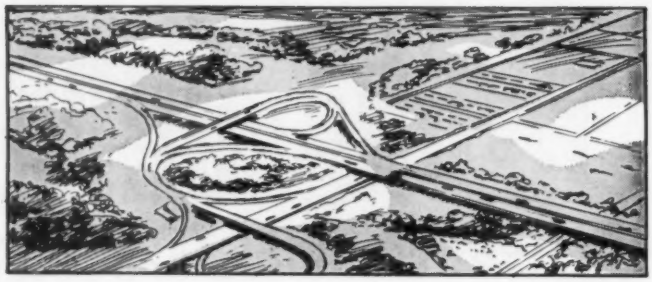


Prepared by **FRANK FORCE,** *Associate Editor*

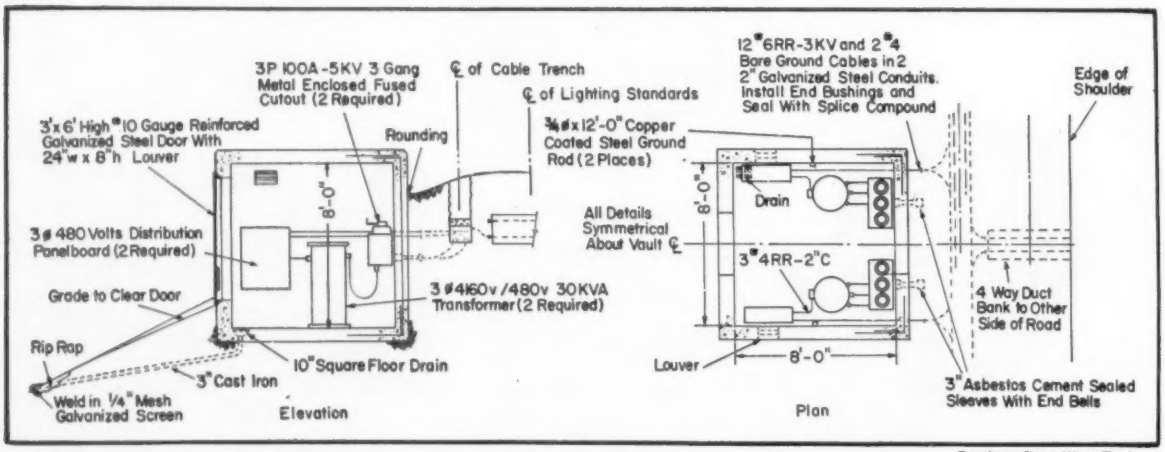
Bypass Lighting Is Different

The urban bypass has become a popular means for diverting through traffic around major cities, as well as a fast route in and out for commuters. Bypasses are controlled access, high-speed roads and their construction differs very little from intercity expressways. The design of urban bypass lighting must include provisions for the following: Good visibility to reduce accidents; sufficient lighting to offset the effects of background illumination; and accentuating points of entrance and exit to the highway as well as other areas. such as toll booths, where traffic must slow down. The Baltimore Harbor Tunnel project is a typical urban bypass. The approaches to the Tunnel make use of 845 four-lamp, six-ft., fluorescent luminaires. Operating at full capacity, the system provides a maintained illumination level of 0.6 footcandle. Fluorescent units were used because they have low brightness, no glare, immediate starting, long lamp life and low lamp replacement costs. Four-tube luminaires make it possible to feed two tubes in each luminaire from a separate circuit. This assures continuity of roadway lighting even if one circuit fails. It also permits operations at 50 percent of capacity during periods of low traffic count. The standards are tapered steel tubes, davit type, with a curved section having a 12-ft. radius and a mounting tenon attached tangentially at the end of this section. Luminaires are mounted at an angle of 25 degrees with the horizontal.

"Bypass Lighting Is Different." By Ernest F. Siegel, Chief, Mechanical-Electrical Engineer, Green Associates, Inc. *Consulting Engineer,* April, 1959.

Radio Communications in Public Works

More than 100 radiotelephone channels have been made available to what is known as the Local Government Radio Service by the Federal Communications Commission. Mobile radio equipment is now being purchased at the rate of $95,000,000 per year. In many public works applications, only short-range communications are required. All-transistor pocket-size two-way radio-telephones will talk about five miles and sell under $100. They can talk further, even up to 20 miles, when the office station antenna is placed above surrounding trees. When greater range is required, the higher-powered radio-telephones should be used and these cost from $450 up for a unit to be installed on a vehicle and as much as $2000 for the office station. Channels are available in the low band (25-50 megacycles), the high band (152-174 megacycles) and the ultra-high band (450-470 megacycles). Greatest range is generally achieved in the low band (as much as 50-60 miles). While the low band is often used for regional or county-wide coverage, the high band is generally used for coverage of a metropolitan area. A mobile radio system may consist of one or more base stations and one or more mobile units; or it may consist of mobile units only. A base station is a radio station installed at a fixed location on a temporary or permanent basis which is used primarily for communicating with mobile units. The communicating range between a base station and mobile units is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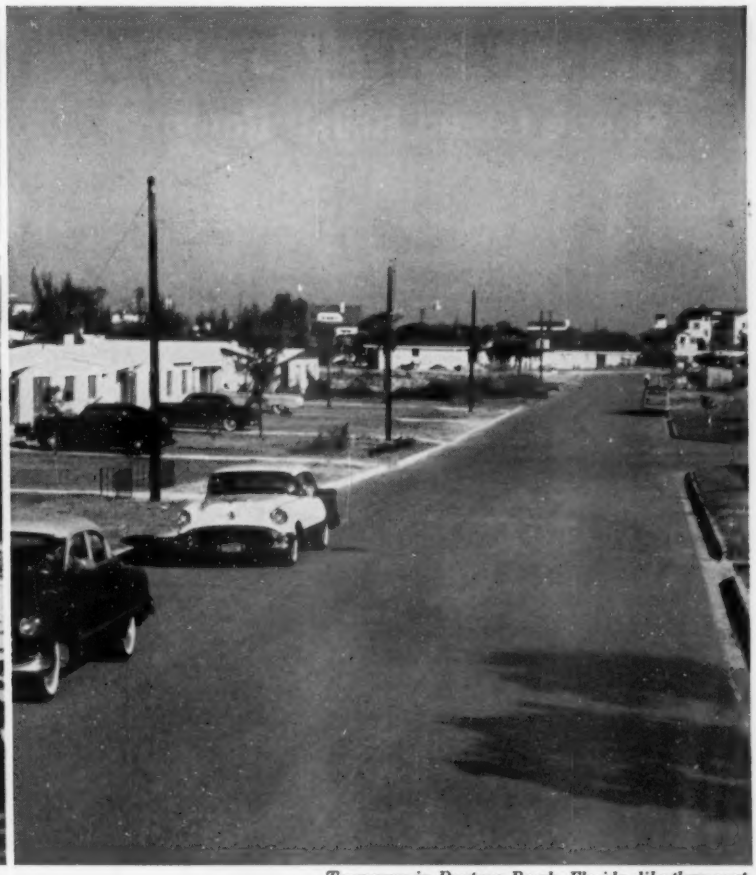
12"6RR-3KV and 2"4 Bare Ground Cables in 2 2" Galvanized Steel Conduits. Install End Bushings and Seal With Splice Compound
Edge of Shoulder
3'x 6' High "10 Gauge Reinforced Galvanized Steel Door With 24"w x 8"h Louver
Rounding
¾"ø x 12'-0" Copper Coated Steel Ground Rod (2 Places)
8'-0"
Drain
All Details Symmetrical About Vault ℄
3ø 480 Volts Distribution Panelboard (2 Required)
3"4RR-2"C
Grade to Clear Door
3 ø 4160v/480v 30KVA Transformer (2 Required)
4 Way Duct Bank to Other Side of Road
Rip Rap
10" Square Floor Drain
3" Cast Iron
Louver
8'-0"
Weld in ¼" Mesh Galvanized Screen
3" Asbestos Cement Sealed Sleeves With End Bells
Elevation
Plan

Courtesy Consulting Engineer

● **FOR BY-PASS lighting, transformer vaults are about a mile apart along the highway with voltage stepdown and cutouts.**

Now is the time for soil-cement...

New subdivision. Soil-cement would be a "natural" here.



Taxpayers in Daytona Beach, Florida, like these neat, low-cost soil-cement streets.

Soil-cement is the low-cost street that grows stronger year by year!

The maintenance crew can all but forget about the streets paved with soil-cement. It holds up like no other low-cost pavement.

Soil-cement gains strength from the minute it's placed. Core tests show it's often double in strength after several years of use.

Soil-cement is stronger inch for inch than any other pavement short of concrete. And its beam strength spreads the load over the subgrade. No softening, no potholing, no break-up in any climate. It outlasts any other low-cost pavements. Maintenance costs *stay low.*

First cost? That's low, too, because in most cases 75% of your materials are free. You need only mix portland cement with almost any soil, then apply bituminous surface to the hardened base. In the case of old streets, the surfacing can be salvaged and mixed right in.

Paving is quick and easy. Contractors can build several blocks a day. Every day more engineers are finding that "now is the time for soil-cement." *Write for free booklet, "Soil-Cement Pavement."* Distributed only in the U.S. and Canada.

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...CONSOLIDATES THE BULK

...LESSENS DUMPING OPERATIONS

...REQUIRES MINIMUM MAINTENANCE

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DEPARTMENT OF PUBLIC WORKS
DIVISION OF ROADS AND BRIDGES - MAINTENANCE SECTION
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September 24, 1956

Mr. W. O. Forman, President
Fitchburg Engineering Corporation
Fitchburg, Massachusetts

Dear Sir:

This is the second year our Fitchburg Chipper has been in service. We are very well satisfied with its performance.

It steps up our brush removal program. It consolidates the bulk, thereby lessening dumping operations. It requires minimum maintenance and manpower.

During the 1955 hurricanes and floods, we found it especially beneficial in disposing of branches and limbs of trees, thus speeding up the opening of the highways.

Very truly yours,

Edmund V. Carlos, Supt.
Northwest Division

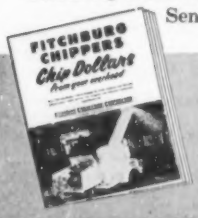
c.c. Mr. Edgar S. Maynard,
Road Maintenance Engineer

Brush disposal cost can be reduced.

Your City will find that the Fitchburg Wood Chipper is money-saving equipment in your Highway or Park Departments. Tree trimmings are quickly reduced into load-saving wood chips. Fewer loads cuts your loading and hauling expenses. Brush removal becomes a faster, simpler, less expensive operation.

Fitchburg Wood Chippers are engineered to stand hard use, to give long service without excessive maintenance costs. There is only one Wood Chipper on the market today with a One Year Guarantee... The Fitchburg Wood Chipper.

Send for a copy of "Chip Dollars From Your Overhead."



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Complete with cutaway color drawings of Chipper in action. Specifications, etc.

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governed by the effective elevation of the base station antenna and to a lesser extent by the power of the base station transmitter. Most of the maintenance work in the equipment is handled by private outside contractors or by licensed personnel employed by the department. If done internally, the technician must be provided with suitable test equipment which will cost at least $1000. There are 17 manufacturers and distributors of radio-telephones mentioned in the article.

"100-Lane Expressway for Public Works Communications." By Leo Sands. PUBLIC WORKS, May, 1959.

Experience With Neoprene Modified Asphalt

Based on nearly one and one-half years of experience in both field tests and routine application, neoprene (synthetic rubber) modified asphalt shows encouraging performance results on Delaware highways. An RC-3 cutback, made from asphalt modified with 1½ percent of neoprene, used with conventional aggregate and standard methods of application, was laid down. To give control in the test, three sections were laid: 1.6 miles with neoprene modified asphalt, 1.1 miles with unmodified asphalt and a second stretch of 1.9 miles with the modified asphalt. The same standard contractor equipment and handling methods were used with the neoprene modified RC-3 as with the control and no difficulties were encountered during or after the operation. In contrast to the unmodified RC-3 control, the modified material showed good "build", no "run-off" during application, excellent chip retention immediately on opening to traffic, and no bleed-through after two weeks of extremely hot weather. Improved adhesion of the chips to the neoprene modified asphalt was readily apparent. Good skid resistance was obtained on the neoprene section; as much as 12½ percent at 40 mph.

"Delaware's Experience with Neoprene Modified Asphalt." By Stanley S. Scarborough, Testing Engineer, Delaware State Highway Department. *Roads and Streets*, April, 1959.

Speed Limit Signs

In 1956, the City of Nashville, Tenn., had a maximum speed limit of 30 mph. With continued improvement of streets and roads, with improvements in the safety features of the modern automobile and with improvement of traffic control and

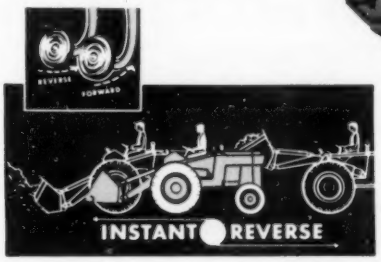
Why is the WORK BULL 1001 so POPULAR and PROFITABLE?

BECAUSE-

Massey-Ferguson has met the challenge to produce a shovel-loader that

- **masters a multitude of jobs**
- **represents low investment**
- **out produces larger, more expensive machines**
- **fills the gap between specialized equipment and small utility loaders**
- **makes maximum use of its power instead of depending upon brute strength alone.**

Seeing is believing. Let your Massey-Ferguson Industrial Dealer demonstrate how this one-cubic yard (payload) unit cycles faster with instant reversing to do more work than machines that cost thousands more. Find out why it digs and gains traction as it loads — and how it has extreme maneuverability and telescopic reach. Check out its many time- and money-saving attachments. You'll see why it pays off on all jobs — large or small.



with INSTANT REVERSE and TORQUE CONVERTER

a TOUCH OF YOUR TOE—*AWAY YOU GO*— FORWARD or REVERSE

NO CLUTCHING . . . NO SHIFTING . . . NO LEVERS TO PULL

WRITE FOR LITERATURE and NAME OF NEAREST DEALER

MASSEY-FERGUSON INDUSTRIAL DIVISION
1009 SOUTH WEST STREET • WICHITA 13N, KANSAS

regulations, it had become apparent to many that the time had come when the universal 30 mph limit was too slow for some sections of the city. The general procedure of the study was to sample the speed actually travelled by the motorists on the test section in each direction under both day and night, peak and offpeak, conditions. Then speed limit signs were changed or erected (in the case of those streets which originally had no signs); and after at least one month had elapsed, the speeds of vehicles were again sampled. The signs were again changed and the whole procedure repeated. A radar speed meter was used throughout the study for measuring vehicle speeds. The following conclusions were reached: Night speeds were about 1 mph slower than during the day under similar conditions; the average speed of vehicles is lower (about 2 mph) during the peak hours than during the offpeak period; vehicles travel at more uniform speed during peak hours than during offpeak hours; posted speed limits have little significant effect on traffic speeds; a single overall speed limit is unsatisfactory and unrealistic because of the wide difference in driving conditions on different streets; and posted speed limits set at the 85 or 90 percentile speed would serve a useful purpose in providing the police with a guide as to what is the maximum speed which can be considered reasonable and prudent.

"Effectiveness of Speed Limit Signs." By T. B. Deen, Director of Transportation Planning, Nashville Traffic Commission. *Traffic Engineering*, April, 1959.

Street Lighting Modernization

The Clinton, Ia., lighting modernization program in the residential areas was financed, one-half by special assessments on the frontage of property benefited at the rate of $4.50 per foot and the balance by general obligation bonds. The spacing of the lights averages 100 ft. along each curb; the poles on the opposite side being staggered. The pole height was determined by the intensity formula and the mounting height was 30 ft. The plans for lighting of the two business districts, which were to be financed by the City, included 177 units with underground wiring. The system was broken up into 15 individual circuits with seven double and one single feed contactors. The wiring at crossings of all alleys, streets, driveways and railroad tracks and the leads up to the feeder poles was run in two-inch rigid metal conduit. The greater part of the cable was laid under the sidewalk, as close to the curbing as possible. A diamond saw was used to cut the trench about 4 ins. wide in the sidewalk. The trench was dug about 12 ins. deep, then about 4 ins. of sand was placed in the trench and the two insulated cables and the one bare cable were laid on the sand. A creosoted pine board was next laid on the cables and the trench filled up with sand to subgrade for replacing the concrete sidewalk. The bare cable is connected to a ground rod at the center of each electrolier base. The concrete bases for the poles were constructed of reinforced concrete. The final estimate shows the cost for 177 electroliers to be $736.14 per unit.

"Street Lighting Paces City Modernization." By Benton R. Anderson, City Engineer, Clinton, Ia. PUBLIC WORKS, May, 1959.

Inspection of Bituminous Concrete Plants

In the administrative organization of the Ohio Highway Department, the State Highway Testing Laboratory is charged with the responsi-

Before you specify, consider how operating efficiency will be increased and long-life low cost performance assured, with these important Baughman ice control features:

LUBE-IMPREGNATED CHAIN DISCHARGE . . . a Baughman exclusive, positively insures greater corrosion resistance and virtually eliminates chain freezing.
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THE LINE RIDER AND HIS GANG of Diamond Chemical killers can rid your roads of troublesome weeds and bushes. They'll do it quickly and save you money like they did out Ohio way, where they saved $18.75 per mile!

Meet the gang:

FOR MIXED BRUSH—LINE RIDER LV-3D/3T, a 2-Ethyl Hexyl Ester formulation of 2,4-D and 2,4,5-T containing 3 pounds each of acid equivalent per gallon.

FOR MAPLES AND OAKS—LINE RIDER LV-6T, a 2-Ethyl Hexyl Ester formulation of 2,4,5-T containing 6 pounds of acid equivalent per gallon.

FOR AREAS ADJACENT TO SENSITIVE CROPS—LINE RIDER AMINE 22, an alkyl amine salt formulation of 2,4-D and 2,4,5-T with 2 pounds each acid equivalent per gallon. Applied as a water-borne spray.

FOR SPECIAL CONDITIONS—Available are other standard LINE RIDER formulations, including Butyl and Low Volatile Esters of 2,4-D and 2,4,5-T containing 4 pounds acid equivalent per gallon.

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SEALTIGHT Rubber-Asphalt Joint Seal maintains adhesion in hot weather . . . will not flow or extrude. Does not smear or track from tires.

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SEALTIGHT rubberized-asphalt compounds provide the ideal sealer for years of economical, trouble-free joints in concrete construction. They feature high resilient and adhesive properties and are able to maintain a bond at below zero temperatures. Will provide a positive seal in all types of monolithic construction. Designed for use with non-extruding type fibre expansion joints.

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RUBBER-ASPHALT JOINT SEAL

RUBBER-ASPHALT JOINT SEAL compound available in both hot-pour and cold-applied types. SEALTIGHT Hot-Pour Rubber-Asphalt meets Federal Specifications SS-S-164 and CAA Specification P-605...SEALTIGHT Cold-Applied Rubber-Asphalt meets Federal Specification SS-S-159 and CAA Specification P-615. Both are ideal for use in the joints of concrete streets, highways, bridges, etc.

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EXPANSION JOINTS specifically designed to meet the needs of modern, properly-designed, properly-jointed construction projects. All types including Asphalt, Fibre, Sponge Rubber, Standard Cork, and Self-Expanding Cork joints available from "stock" at your local SEALTIGHT distributor. Meet Federal and State specifications.

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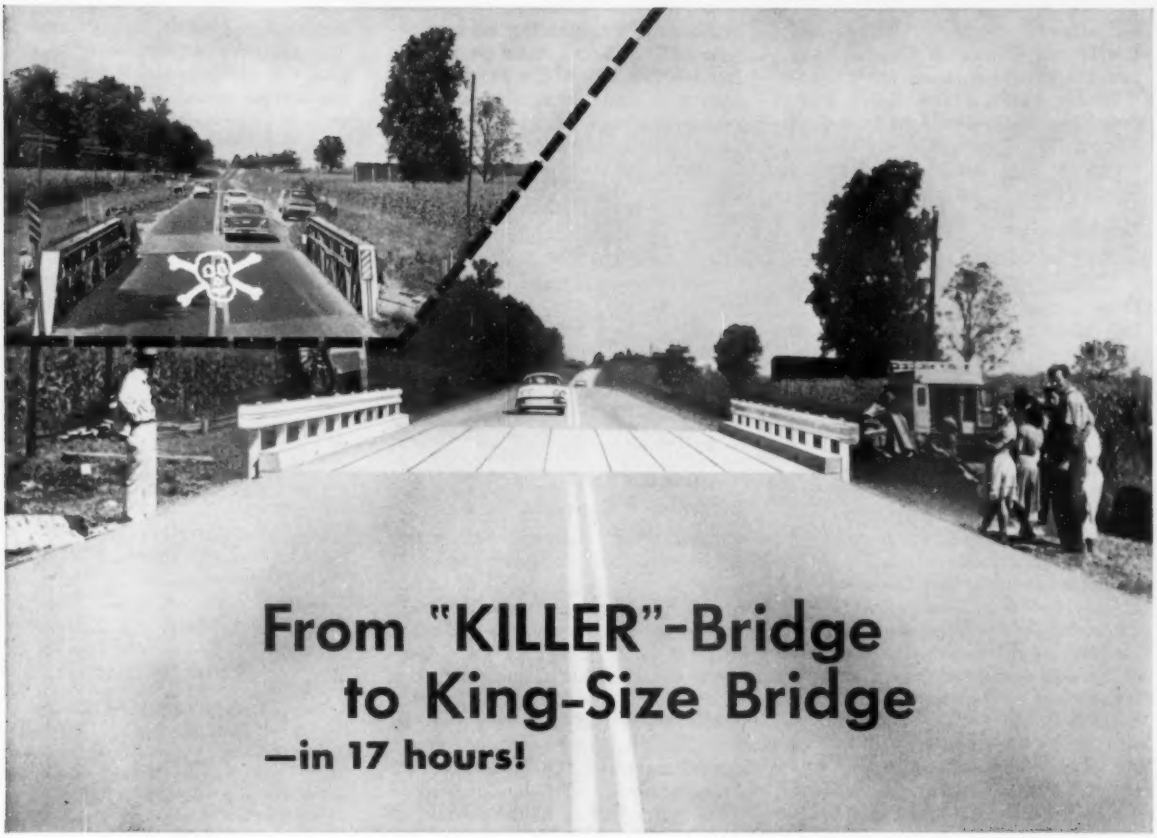
bility for the design of bituminous concrete mixtures and the inspection of bituminous concrete manufactured for Department projects and maintenance orders. Bituminous concrete plant inspectors and field centrifuge operators are employed by the 12 Division Offices of the Department. In general, one plant inspector, one field centrifuge operator and one ticket writer are assigned to each plant operation. In the spring the Laboratory conducts an on-the-site training school for inspectors and centrifuge operators. Before operations start at a plant, a traveling engineer or inspector checks it out so that it conforms with specification requirements. The Division Engineer of Tests is responsible for obtaining samples of the material that will be used in the work and submits samples to the Laboratory so as to permit completion of the tests in advance of plant operation. The equipment for test and inspection is supplied by the Laboratory and the Contractor furnishes a suitable building or work space for the exclusive use of the Departmental Personnel.

"Bituminous Concrete Plant Inspection." By F. M. Williams, First Assistant Engineer of Tests, Ohio State Highway Testing Laboratory, Columbus, Ohio. PUBLIC WORKS, May, 1959.

Scale Models Help Solve Highway Problems

A third dimension is essential to better understanding of highway planning and this is shown by the building of a detailed model of the proposed interchange at the intersection of Ogden Ave. and Cicero Ave. in Cicero, Ill., at Chicago's western corporate edge. A scale model of the project was made by the Creston Industrial Model Co. of Creston, Ill. This model, constructed in color, is 88 ins. wide and 140 ins. in length. It is composed of seven interlocking sections at a scale of 1″ = 21′ —2″ both horizontal and vertical. Total weight is slightly under 2000 lbs. The major portion of the model is built of basswood. More than 100 lb. of metal alloy, mainly lead with some cadmium and bismuth, was used in casting hundreds of small pieces. The molds were either wood or rubber. More than 100 ft. of fencing, 220 buildings, 150 ft. of railroad track, 250 light poles and 80 bridge spans were incorporated in the model. The basic price is $100 per sq. ft. and increases with the amount of detail requested. A 3D picture of a proposed subject, when studied by the layman and civic groups, is



with AMDEK Concrete Beams

Only 17 hours were required by the Indiana State Highway Department to eliminate a deadly old "Killer" Bridge and replace it with a modern, wide structure near Scottsburg, Indiana. This new Amdek Bridge is not only safer to cross but is constructed of maintenance-free concrete.

American-Marietta Company makes precast concrete beams for spans up to 36 feet and prestressed beams for longer spans. All are economical and made under factory-controlled conditions—delivered to the job quickly from American-Marietta plants strategically located throughout the nation.

Write today for colorful new Amdek brochure

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GENERAL OFFICES:
AMERICAN-MARIETTA BUILDING
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an effective public relations aid. De Leuw, Cather & Co., Chicago, are the consultants on the project.

"Scale Model Helps Solve Difficult Interchange Problem." By C. R. Shupe, De Leuw, Cather & Co., Chicago, Ill. *Street Engineering*, April, 1959.

Cost Sharing Street Construction

Alamosa, Colo., cost sharing street construction program benefits the individual property owner and the city at large. The 1958 program covered the paving of 16 blocks and, in 1959, 34 blocks are being planned for reconstruction. The property owner benefits by a reasonable assessment—$3.40 per front foot for his half of a 52-ft. wide street, including paving, curb and gutter, the necessary drainage facilities, storm sewer connections, manholes, catch basins and incidental costs of interest, legal fees, fiscal agent, clerical work, etc. Soil-cement base paving was used because the character of the soil permitted the use of only six percent cement to make an ideal base. A Smith-Field automatic curb and gutter machine owned by the city laid a 2-ft. wide curb and gutter at a cost of $1.08 per lineal foot, which included all labor, materials, excavating, engineering and backfilling. The 5-in. street base was constructed by using a Pulvi-Mixer and pneumatic roller. After final rolling, 0.25 gal. psy of MC-3 asphalt was applied to the surface. To make the 1-in. asphalt wearing surface, the aggregate was placed on the base and about 13.5 gals. of asphalt per ton was applied and mixed by the Pulvi-Mixer and the blades. A seal coat consisting of 0.25 gal. of asphalt psy was applied to the top of the mix and then covered with sand or asphalt.

"Cost Sharing, Cost Saving Street Pavement." By Glynn Mills, City Manager, Alamosa, Colo. *The American City*, April, 1959.

Techniques For Using Prestressed Concrete

Prestressed concrete has many advantages and disadvantages. It is not suitable for all types of structures and should never be designed as a prestressed concrete umbrella. A prestressed structure has lower stresses under the normal load, but in most cases prestressing cannot contribute to any great extent to the failure load which the structure can withstand. The possibility of reducing the weight does not come from the reduction of the section of concrete subjected to compression. The sectional area needed to contain the steel, however, still maintaining the necessary concrete cover, will be much less for prestressed concrete because of the increased stress in the steel. In a bridge of larger span, a much thinner web may be used for the beams. In many cases, a thicker web must be used because of the shear stresses in reinforced concrete; in prestressed concrete the shear stress will be reduced considerably by the prestress. In prestressed concrete the concrete can be used in tension. There are several other examples mentioned in this article on the use of prestressed concrete. These are cylindrical tanks, shell structures, trussed girders and frame bridges.

"Techniques For Using the Advantages of Prestressed Concrete." By Professor H. Rüsch, Institute of Technology, Munich, Germany. *Contractors Record and Municipal Engineering*, March 19, 1959.

Other Articles

"Some **Recent Trends in Surveying.**" By A. Bannister and S. Raymond, Senior Lecturers in Civil Engineering, Royal Technical College, Salford. The Surveyor, February 7, 1959.

"Standard Plans for Bridges." Several

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RAMFLEX
A SPECIAL RUBBER MATERIAL FOR ROADS, DRIVEWAYS, PARKING AREAS AND ASPHALTIC PAVEMENTS OF ALL TYPES
IDEAL FOR HOT PATCH APPLICATIONS
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don't SPLIT or BREAK even after our SEVERE weather",

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"Saves time and labor and gives us better roads.

"In our 200 miles of roads to be maintained we have found Ramflex has definite advantages. It imparts rubberiness to asphalt so that our roads resist splitting in cold weather. Similarly, it makes asphalt less brittle which holds the aggregate firmly in place—thus reducing breaking. Asphalt containing Ramflex does not emulsify and retains its adhesion to the base—moreover, no shoving has been noticed even under heavy traffic conditions." All this adds up to better paving at low cost and practically no maintenance. And—Ramflex Rubber Roads are especially appealling to motoring taxpayers because "when rubber rolls on a rubber road . . . everybody "SAVES".

RAMFLEX is a special rubber powder, developed by the U. S. Rubber Reclaiming Co., and can be purchased in any amount. Ramflex is added directly to the aggregate in pug mill before the asphalt. Can be put down by any competent asphalt contractor and requires no special equipment.

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Dowflake and Peladow save in road maintenance too! Engineers estimate that untreated roads lose about 200 cubic yards of aggregate per mile in a year; while calcium chloride treated roads show an average loss of *only 25 cubic yards!* Thus the binding effect of Dow calcium chloride reduces gravel loss and blading costs by *as much as 80%!*

Settle dust problems the easy, economical way by using Dow calcium chloride! Dow's Highway and Construction Materials Engineers will be glad to help you with information or engineering counsel.

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What is YOUR litter problem?

Litter or leaves in your **gutters?** On your **playgrounds—underpasses—center malls—parking lots—bridges??**

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Compact—powerful. Gobbles litter . . . bottles . . . cans. No brooms to wear.

TARCO **"Litter Getters"** clean **clean**—Quick.

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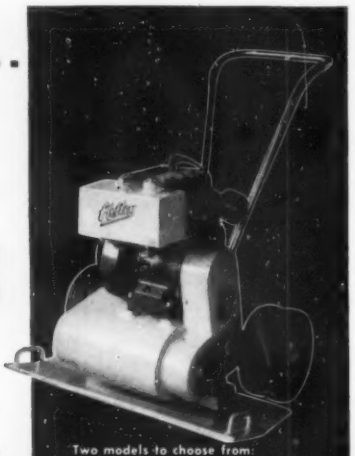
Twenty-four hundred times a minute the Kelley 36KT Power Tamper hits with a force of tons, with the compacting force of a massive power roller. But Kelley Power Tampers are handier than rollers. They can pack earth backfill to maximum density next to foundations, piers, in pipeline trenches, on road jobs, etc. Also for finishing blacktop, with heater shoe attachment available.



Two models to choose from: Model 36KT (above) with 30" or 36" wide shoe, and Model 18KT with 18" or 24" wide shoe.

Below, Model 18KT packing down sub-base materials on a road-widening job.

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Please send us information on Kelley Tampers.

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states are using **standard plans for bridges** 20-ft. in span and under and these structures are being used on primary and secondary roads. Public Works, May, 1959.

"Radar Joins the Survey Party." Electronic equipment is saving time in highway surveys. Latest units available are described in this article. By Floyd W. Hough, Geonautics, Inc. Consulting Engineer, April, 1959.

"Work of a **Public Lighting Department.**" The Lighting Engineer of the City of Sheffield discusses the main purposes of urban street lighting and stresses the importance of adequate illumination for residential areas of cities. By C. J. Chisholm. Contractors Record and Municipal Engineering, March 25, 1959.

"The Traffic Program is Paying Off in New Brunswick." **Accidents reduced 32 percent** in two years. Citizens also see other results from high priority placed on solving traffic ills on city-wide program basis. By Vincent I. Cassera, City Planning and Traffic Engineer, New Brunswick, N. J. Street Engineering, April, 1959.

"Illinois Expands Its **Edge Striping.**" New equipment handles big daily mileages of edge striping, reducing traffic delays. Roads and Streets, April 1959.

"That Line Down the Center of the Road." Texas Highway Dept. **paints center and barrier lines** on 45,270 miles of highways. By Nella Dieter, Journalist, Information and Statistics Div., Texas Highway Department. Texas Highways, April, 1959.

• • •

Revenue on Garden State Parkway

The year 1958 produced gross operating revenues of $16,777,912 on the Garden State Parkway, N. J. This total consisted of $15,972,742 in tolls, $768,451 from service areas, and $36,719 from miscellaneous receipts.

Toll revenue during 1958 was up $1,584,007 or 11 percent over the year 1957. This revenue was also $748,742 or approximately 5 percent over the Consulting Traffic Engineers' estimate for the past year. During the year 1957, actual toll receipts exceeded the Engineers' estimate by 3 percent.

Chemical Weed Control

During 1958, 4,840 gallons of 2,4-D were applied to approximately 5,600 acres of grass areas along 1,030 miles of roadside in Wayne County, Mich. Also, 254 gallons were used on 428 acres of lawn areas in County parks. The average cost per acre was approximately $8.

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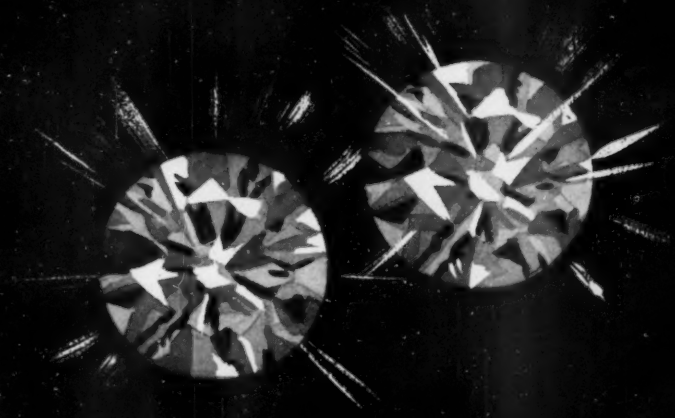
They LOOK alike...



BUT...

Two stones may look alike, making it difficult to decide which one is the diamond. So it is with lighting standards. Two steel standards may look the same, but only Kerrigan standards have these plus values:

1. Superior strength, with stronger bracket connections
2. Heavier wall thickness (.130)
3. More resistance to bending—less deflection
4. Drop forged steel anchor base
5. 4 to 6 times greater resistance to corrosion
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7. One continuous longitudinal weld—Magnafluxed
8. Octagon shape—Inherently stronger than the round or fluted
9. Trim, modern lines, architecturally correct

NEW from KERRIGAN — THE CLASSIC Pat. Pending

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does the work of 2 smaller rigs for .....

speeds truck loading

8' dump clearance, with 37" reach, enables you to fill trucks fast. Note how tilt cylinders stay parallel with lift arms . . . no pinching or shearing action to endanger operator.

get a free demonstration . . . see how this NEW 1-cu. yd.

7800 lbs. of breakaway

Enables you to fill bucket quicker for faster load-and-dump cycles.

no bounce, no dip, no sway

Better weight distribution means greater safety, less spill loss.

attachments add versatility

Bucket interchanges with rotary broom, pallet fork. All-weather cab available.

W-5 TERRALOAD'R

..25% less cost!

Available on monthly
LEASE
— with or without down payment or trade-in.

Here, at last, is a *full cubic yard*, 1½-ton capacity, unit loader that will move as much material under normal conditions as *two* smaller wheel rigs. What's more, you *save up to $1500* in budget cost because major components — including engine and transmission — are engineered and built by *J. I. Case*, instead of being purchased from *"outside"* sources.

more good news!

With the Case-powered W-5 you get just the *right* combination of engine power and machine weight to insure maximum output, with *minimum fuel consumption*. Torque-converter drive doubles push-pull power instantly, automatically — *without clutching, shifting or stalling*. Forward-reverse power-shift, coupled with front-wheel drive and rear-wheel power-steer, provide exceptional maneuverability and ease of handling.

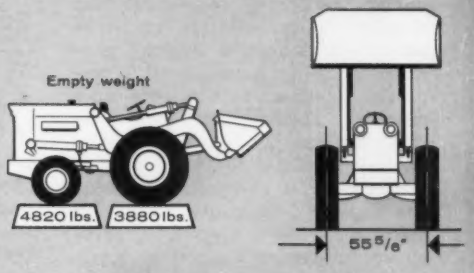
6 equipment options ... more coming!

The W-5 is available now with interchangeable 1-cu. yd. or 1½-cu. yd. (light material) bucket, pallet fork, block fork, rotary broom, and optional all-weather cab. Other add-on attachments coming soon. So don't delay. Mail handy coupon today for full details and a free W-5 demonstration on your job.

CASE®
J. I. CASE CO., RACINE, WIS.
World-wide sales and service

73% MORE CROWDING POWER gets heaped loads faster

You've never seen anything to match the fast, smooth crowding action of the Case W-5. *Parallel-circuit* control-valve applies full power from 30 gpm pump to *both* lift and bucket-tilt cylinders at the *same time*. In addition, tilt cylinders use *full* piston area on breakout stroke, to produce a total breakaway force of 7800 lbs. — *73% more than any competitive machine* in the W-5 price range.



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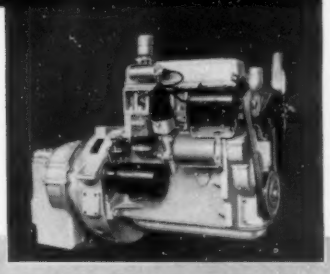

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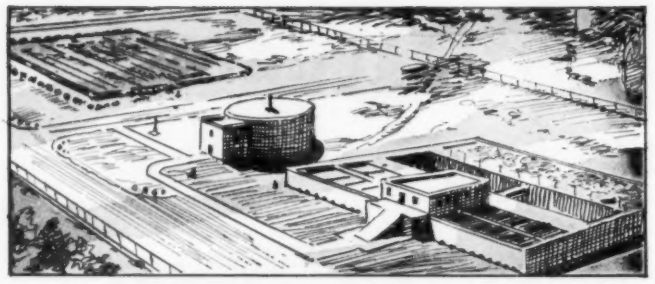


Prepared by **ALVIN R. JACOBSON, Ph.D**

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

Safety Programs

Why is there so little evidence that any substantial progress has been made in sewage works safety during the past fifteen years? The absence of an effective employee safety and industrial hygiene program in public employment is regrettable but is a fact in most communities. The apparent reason is that accident prevention programs do not have the active support of management in the majority of our American municipalities. In all too many local sewage works departments no one is trained to teach safety. In contrast, gas, telephone and electric utilities, and numerous private corporations, have active safety programs for their employees. Those in charge of sewage works must: 1) Study the accident record to see where accidents are occurring, and why; 2) recognize inherent hazards; 3) provide safety equipment; 4) insist on safe practices; and 5) encourage safety-thinking by all employees. To promote safety and prevent accidents during construction work, a study should be made of the work area to prevent hazardous conditions or operations; adequate supervision of the movement of large equipment in a safe manner is essential; adequate precautions should be taken during excavations and pipe-laying operations to prevent serious accidents; protective apparel should be worn to reduce personnel accidents. During maintenance operations, adequate protection to both the sewer workers and the public is required. This includes barricades, signs and indicated traffic lanes whenever sewer manholes are open and maintenance equipment is in use in thoroughfares. It also includes prevention of infections through first-aid measures and use of protective equipment under adequate supervision to prevent asphyxiation or explosions in sewers. In addition, personnel should be trained to apply the back pressure arm-lift (Nielson) method of manual artificial respiration.

"Safety in Sewer Construction and Maintenance." By Leroy W. Van Kleeck. PUBLIC WORKS, May, 1959.

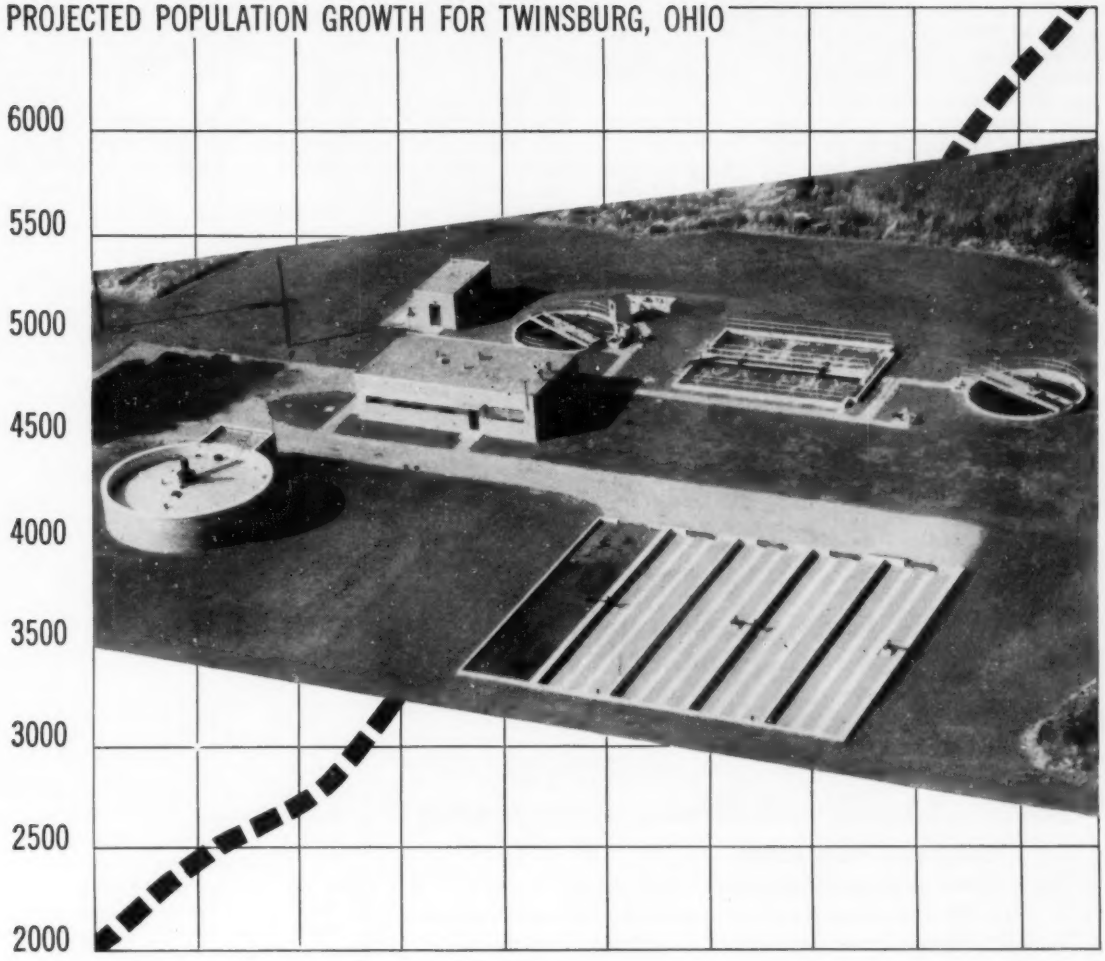
Sewage Treatment in Germany

In West Germany there are about 50 million inhabitants, of which 41 million are served by central water-treatment plants, but only 50 percent or 25 million are served by municipal sewers and only 34 percent of this municipal sewage is treated at sewage plants before it is discharged into water courses. In the last 5 years about $360,000,000 were spent by municipalities alone for sewer systems and sewage treatment works in West Germany. Up to 1960, additional expenditures of $400,000,000 are foreseen for this type of work. Several years ago there were organized the well known West German economic water associations, the oldest of which are the Ruhr Association and the Emscher Corporation. These associations consisted of all the designated cities, districts, mines and large industrial undertakings working together with one goal, that is, to carry out both the water supply and maintenance of the purity of the watercourse and the drainage of the entire district in accordance with uniform plans, as well as all inclusive communal problems. It is the special characteristic of these organizations that all economic measures relating to water are not only supervised and planned by them, but also that they are even executed and managed by them. In other words, it is the business of the sewerage districts to plan, to build, and to manage the sewage treatment works required to treat the sewage for the cities situated in the district. Since the purification of the sewage is incumbent upon the whole drainage district, they are able to carry out new kinds of treatment and to combine technical with economical measures. As an example, by raising the Ruhr in a chain of great reservoirs, the flow-through time and the water surface of the river are increased thereby increasing the ability of the river to purify itself through intensive oxygen absorption at the surface. These lakes are also connected with hydro-electric plants. The revenue from the sale of electric current compensates to a great extent for the additional cost for construction of the dams and the cost of purifying sewage by natural means in these impounded reservoirs is almost nothing. The author presents in this article a thorough discussion of the types of primary sewage treatment plants being designed at the present time in West Germany. Several sketches and photos add to the value of this article. A discussion of secondary sewage treatment plants will appear in a forthcoming issue of the magazine.

"Wastewater Technology in Germany." Part I. By Dr. Ing. H. Rhode. *Water and Sewage Works*, April, 1959.

Sludge Density Analyzer

The possibility of automatically controlling sludge density during its removal and disposal intrigued the personnel at the Columbus, O., sewage treatment plant. Consequently, they installed one of the newest nucleonic-electronic systems —the AccuRay Continuous Density Analyzer for the problem of sludge handling. The success of this nucleonics innovation is leading to new plans to apply this "automation" principle to other phases of plant operation and control. The



Twinsburg, Ohio plans ahead . . .

Twinsburg, Ohio, located between Cleveland and Akron, is an outstanding example of a small town which is planning for the future. The new Twinsburg Sewage Treatment Plant will provide for triple the present population.

Whether Twinsburg's population grows from its present 2,000 to 6,000 in a year or in ten years their sewage disposal requirements will be taken care of. This kind of farsighted planning will help improve and conserve America's water supply. Willard F. Schade & Associates, Cleveland were the consulting engineers.

P.F.T. equipment at Twinsburg includes: one 45′ Floating Cover, one #170 Heater & Heat Exchanger Unit (Gas Fired), one lot Gas Safety Equipment and one UFP Aluminum Roof Deck.

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system consists of three basic units: 1) A measuring head which is clamped to the outside of the pipe; 2) a pre-amplifier; and 3) a measuring instrument. One outstanding advantage of the system is that the equipment is mounted externally on the piping and no component ever touches the sludge which it is measuring. The measuring head is composed of two primary components: 1) A source unit which contains a radioisotope source material; and 2) a detector unit which is sensitive to very small changes in energy from the radioisotope source. As the sludge passing the unit varies in percent solids, the amount of energy reaching the detector varies proportionately and a current is produced in the detector. This current is passed on to a pre-amplifier and then to a measuring instrument where the signal is shown, in terms of direct units, by a dial on the face of an instrument or a suitable recorder which provides a permanent record of the solids variation. Suitable controls can be installed to provide split-second feed-back control of the operations. One of these units was installed at the Columbus sewage treatment plant and has been in full-scale operation since mid-1958. The results obtained from the AccuRay system have been excellent and new plans are being made to apply this "automation" principle to other phases of plant operation and control.

"Continuous Density Analyzer Records Sludge Concentration." *Wastes Engineering*, April, 1959.

Sewer Service Charges

Sewer service charges are becoming a means of requiring users of sanitary facilities to participate directly in the financing of the construction, operation, maintenance and debt liquidation of sewage works. A review of several hundred sewer service programs showed that there are 18 common methods of charging for the privilege of contributing wastes to municipal sewers and sewage treatment works. The three basic revenue procedures that underlie these 18 different sewer service charges are: 1) Imposition of a flat rate per residence, building, or lot, which will produce required revenues, independent of the amount of wastes discharged to sewers; 2) rates based on the volume of wastes discharged to sewers; and 3) rates determined according to the characteristics of the liquids discharged. The flat-rate sewer charge is relatively simple to set up and operate and it can be levied against the property owner or the tenant as the case may be. Where it is considered advisable to base sewer charges on some measured volume of wastes discharged, many communities have found the water rate is a convenient starting point. The third sewer rental fee system is based on the principle that certain wastes are difficult and costly to collect and treat. Each of the 18 common variations in the three basic sewage works revenue-producing methods are described.

"18 Methods for Setting Sewer Service Charges." By Frank Reid. *Wastes Engineering*, April, 1959.

Photogrammetry Keys Sewer Work

Demands of phenomenal post-war residential and industrial growth have forced planning and mapping action to provide integrated sewerage for a great segment of Long Island, New York. About 107 square miles of the central and south portions of Eastern Nassau County are without public sewerage. Some 70% of the land area has been developed and 140,000 homes are served by individual

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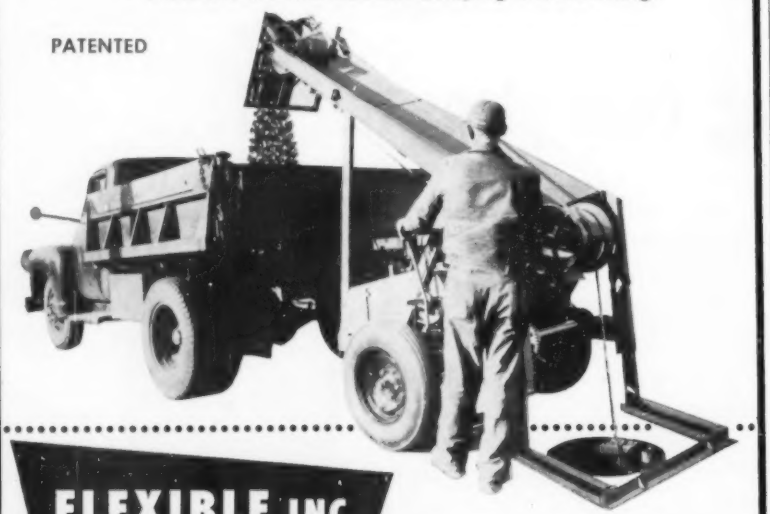

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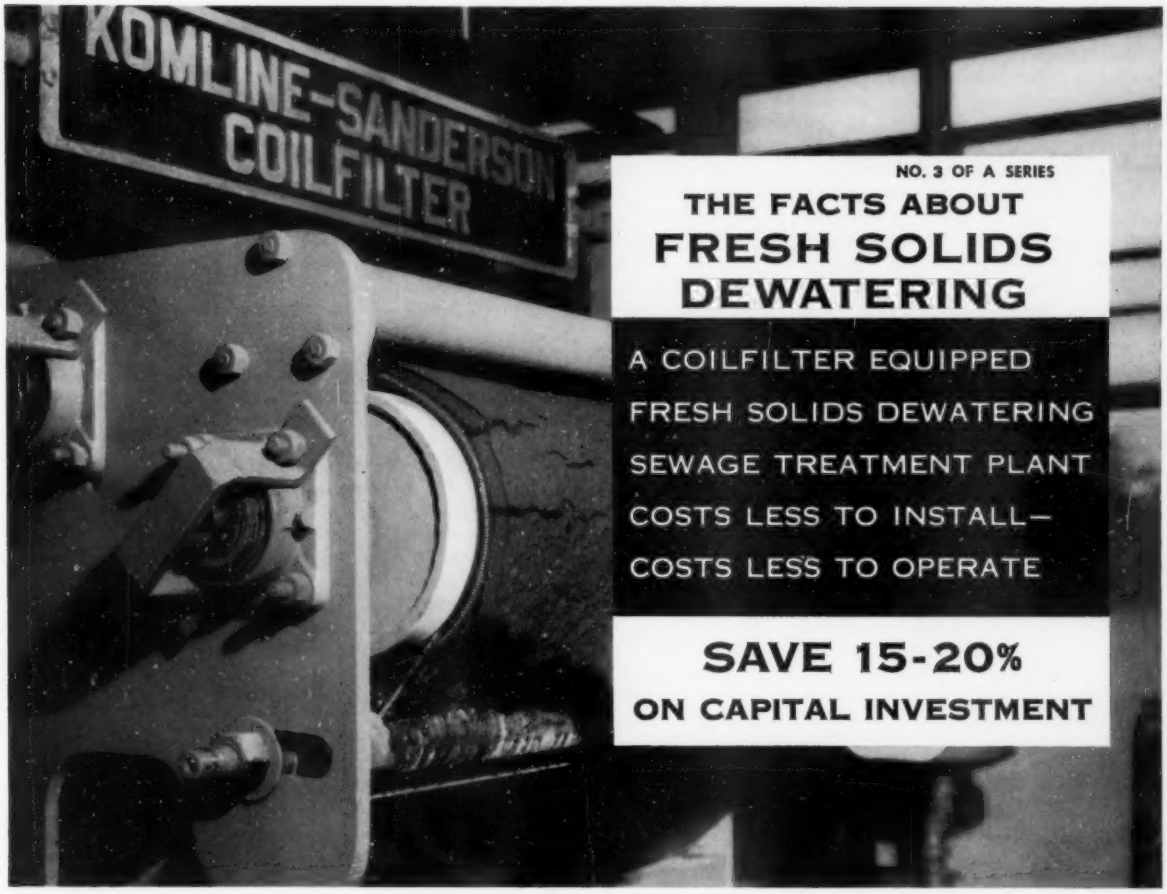

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A sewage treatment plant incorporating Coilfilter fresh solids dewatering can be installed at a capital investment saving of 15-20%. Less land area, fewer structures, less piping and auxiliary equipment are required than with a system involving digested sludge.

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Total operating costs for Coilfilter fresh solids dewatering, plus disposal, amounts to 10-30 cents per capita, per year—including all labor and equipment. Labor costs are lower, since less manpower is necessary.

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sub-surface sewage disposal systems. These systems have served fairly satisfactorily, but municipal and county officials have recognized that public sewerage cannot be put off. The county obtains its water exclusively from ground water supplies. In fact there are more than 620 public supply wells in some 50 supply systems. In addition, there are about 580 industrial supply wells. The region has this two-fold problem: 1) Protection of the ground water supply against pollution; and 2) adequate recharge by storm water run-off (45 inches annual precipitation) to assure a continued pure and adequate supply. The collection system and the sewage purification project were designed to satisfy these critical water needs. Photogrammetric methods were used instead of costly, time-consuming conventional survey methods. Aerial photographs for mapping were taken at an altitude of 2,500 feet and photography for aerial triangulation and photoplanimetric revision was done from a plane flown at 6,000 feet. A total of 450 photographs were necessary for aerial triangulation and 1,925 photographs were used for stereoscopic compilation. A Fairchild six-inch Cartographic precision mapping Camera was used exclusively for photography and a Wild A-5 first order stereoplotter was used for extension of control. Kelsh plotters were used for compilation. These key instruments project 3-dimensional images from overlapping aerial photos to provide contours and other data traced in map-making. The estimated cost of the entire eastern Nassau sewerage system, including complete biological treatment by activated sludge process, will be $227,000,000.

"Photogrammetry Keys Sewer Project For 140,000 Postwar Families." By Wm. F. Cosulich. *The American City*, April, 1959.

New York Sludge Disposal

Sludge from activated sludge sewage treatment plants in New York City is being disposed of by either of two methods: 1) Disposal at sea; or 2) to city parks. Disposal by barge to sea has been found economical, sanitary and extremely flexible. Since 1935, when the first sewage treatment plant was placed in operation, additional sewage treatment plants have been constructed so that the total installed capacity in modern plants as of 1958 was 901.5 mgd. Of this, 820 mgd is of the activated sludge type, employing either step aeration or modified aeration. Normal sludge disposal from all but three small plants is by transfer to sea-going diesel-operated vessels which dump the sludge at a point 12 miles from shore. Transfer of sludge from storage to vessels is by gravity except at two plants where pumping is required. Sludge from the 225 mgd Wards Island plant is raw; that from all other plants is digested. In 1957, of the 91,000 dry tons of sludge removed to sea, 45,500 tons were produced at Ward's Island. Current costs of $0.66 per wet ton and $13.70 per dry ton are believed to be only a third or a quarter the cost of vacuum filtration and incineration when all factors are evaluated. At the same time about 5 to 10 percent of the digested sludge produced is conveyed to park areas where it is used by the Park Department to produce synthetic topsoil on completed sanitary landfills. Experience to date indicates that such sludge mixed with sand fill, will produce satisfactory green cover at a fraction of the cost of importing topsoil. About 1,700 acres are planned to be covered with synthetic topsoil produced from digested sludge. It is estimated that

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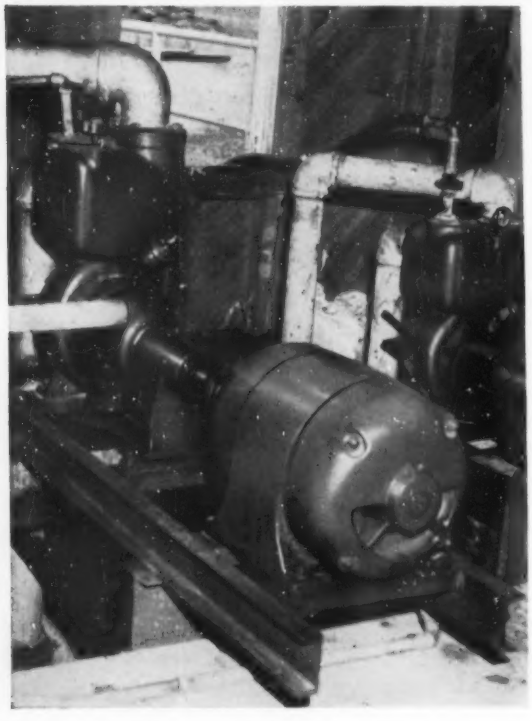

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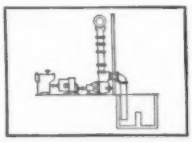

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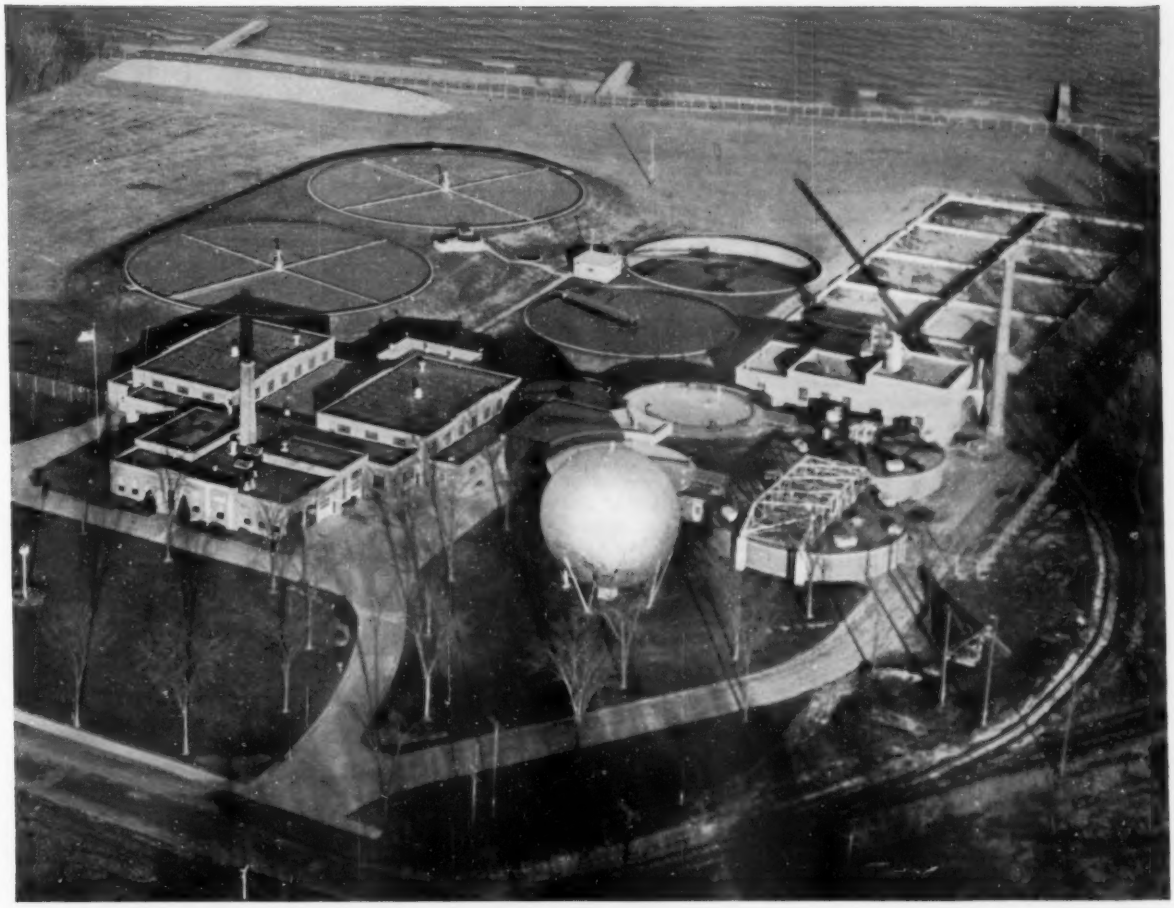

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prepares for 1990 with new secondary treatment facilities

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over 1,000,000 cu.yds. of topsoil will be needed in the next few years. A detailed discussion of both methods of sludge disposal is presented in this article.

"New York Sludge Goes to Sea or to Parks." By W. A. O'Leary. *Civil Engineering*, April, 1959.

Sludge Digestion

Investigations have been conducted at the sewage treatment works serving the City of Baltimore, Md., to determine the extent to which the rate of digestion of raw sludge could be increased. The laboratory and plant-scale experiments have shown that raw solids can be digested in about 10 days if the weight ratio of digested volatile solids to raw volatile solids in a digester mixture is maintained at 1 to 1. It was also concluded that intimate mixing of digested and raw sludge is important to the digestion rate. In addition, more gas was produced per unit weight of raw volatile solids as the ratio of digested solids to raw solids was increased. The obvious advantages of increased capacity and design economy are evident from the results of these investigations.

"Effects of Premixing Raw and Digested Sludge on High-Rate Digestion." By C. E. Keefer. *Sewage & Industrial Wastes*, April, 1959.

Other Articles

"O.R.P. and Sewage Treatment". Oxidation-reduction potential is another tool being applied to the control of sewage treatment processes. By J. W. Hood. Public Works, May, 1959.

"Geodesic Space Frame Over **Trickling Filter.**" The problem of controlling odors at the Sarasota Treatment plant was solved. By W. W. Gillespie and A. J. Birchall. Water and Sewage Works, April, 1959.

"Studies on the Occurrence and Degradation of Condensed **Phosphate in Surface Waters.**" The studies reported in this paper are concerned with 1) the concentrations of condensed phosphates found in sewage effluents and in surface waters in Illinois, and 2) the persistence of condensed phosphate compounds in natural waters. By R. S. Engelbrecht and J. J. Morgan. F.S. and I.W.A., April, 1959.

"Overflows of Sanitary Sewage From Combined Sewerage Systems." The problem of what to do about pollution associated with overflows of mixed sanitary sewage and storm water from combined systems is thoroughly discussed in this article. By Thomas R. Camp. F. S. & I. W. A., April 1959.

"Chemical Composition of the **Particulate Fractions of Domestic Sewage.**" This paper reports on the organic composition of the insoluble fraction of sewage in addition to the inorganic constituent of the insoluble, as well as soluble fractions. By H. Heukelekian and J. L. Balmat F. S. & I. W. A., April, 1959.

• • •

Plastic Liner Repair

As a result of inspections conducted by members of the Sewer Design Division Dept. of Public Works, Los Angeles, Calif., during January, 1958, a relatively small section of damaged plastic liner was found to exist within the La Cienega-San Fernando Valley sewer at a location where a high velocity flow entered from a by-pass.

After analysis of the damage, plans were prepared for repair. During the design period, detailed discussions and conferences were undertaken with the representatives of the manufacturer of the plastic liner. A method of repair was evolved which consisted essentially of the installation of unique wire reinforced laminated sheets over the damaged plastic by means of specially machined stainless steel studs driven by explosive charges.

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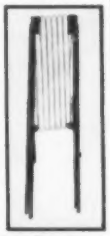

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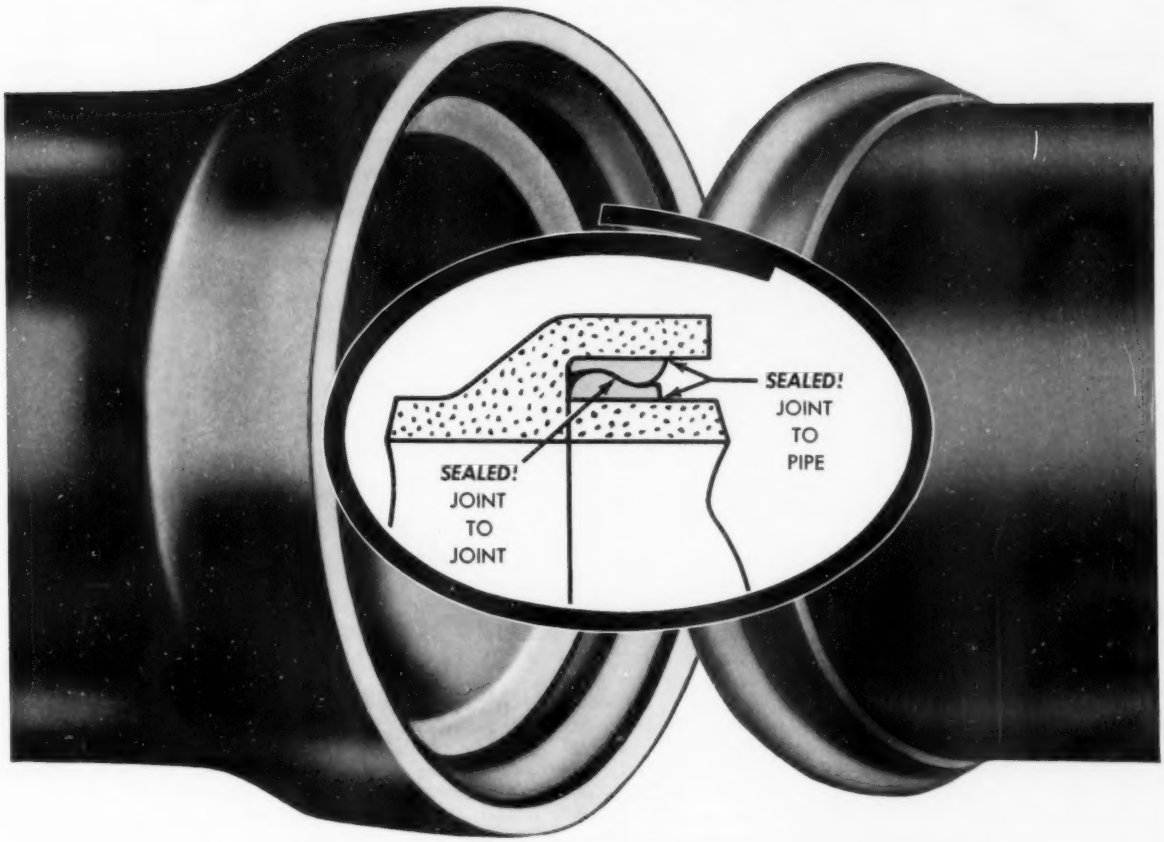

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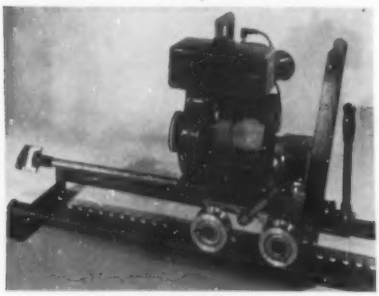

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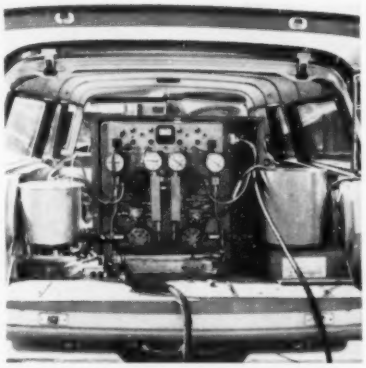
standard plastic sheets and then molding under heat and pressure. Investigation of commercially available steel studs revealed that none was sufficiently corrosion resistant, and it was therefore necessary to test experimentally studs fabricated from a comparatively new steel on the market. The test studs were fabricated at the machine shop of the Hyperion Sewage Treatment Plant. When these studs were test fired into concrete, they met all of the requirements.

SPRAYED-ON EPOXY COATINGS

A FORWARD step has been made in the coatings industry with the announcement by Union Carbide Plastics Co. of a new technique for spraying epoxy resins. This technique, based on the use of the specially designed "Gusco" process equipment, provides a practical approach to the mixing of 100 percent reactive two-component systems.

This equipment combines the advantages of a heated hose and supply pot and a specially designed spray gun. Heating of the supply channels reduces the viscosity of resin and hardener systems to sprayable consistency. Pot life problems are eliminated by use of the spray gun, which automatically combines metered epoxy resin and hardener only a fraction of a second before the mixture is propelled from the gun. The gun is also self-cleaning, therefore it is always ready for use.

Used in combination with accessory equipment such as sand and metal fiber blowers and glass fiber cutters, the "Gusco" process equipment produces a great variety of end products ranging from textured coatings to reinforced plastics. This equipment has been used to apply protective coatings to walls and concrete tanks, to repair rotted industrial roofs and broken concrete curbs, to lay down non-skid coatings, and to fabricate glass-fiber reinforced epoxy boats and metal reinforced vacuum-forming molds. These applications are just beginning but they serve to illustrate the multitude of jobs that epoxies can do easily, effectively and economically.



● **SPRAY gun assembly for application of epoxy resin and hardener may be carried in back of a station wagon.**

"Gusco" process equipment is made by A. Gusmer, Inc., Woodbridge, N. J. "Bakelite" epoxy resins are manufactured by Union Carbide Plastics Co.

● **EPOXY resin coating being sprayed on sedimentation basin walls of Union Carbide Co. water plant in 1958. This was the first spray application of the resin.**

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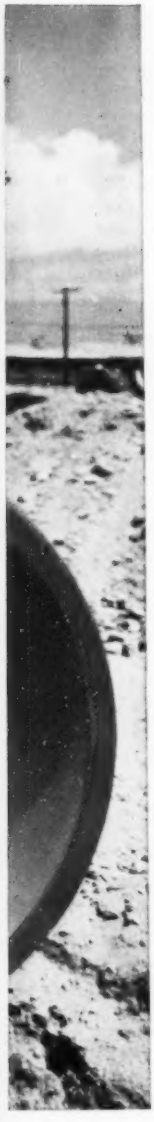
MUNICIPAL OFFICIALS SAY:

"Reduces water costs"



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Read what leading water system designers, installers and municipal officials say about many economies of Johns-Manville Transite Pipe

MAYOR *Walter Reynolds, Providence, R. I. says—*
"An efficient water system ranks high among the many advantages Providence offers industry. Since 1935, Transite Pipe has ably served in the continuing job of keeping our water system more than capable of meeting future needs. In this way our water system contributes not only to the health and convenience of our citizens, but also to the encouragement of industrial and economic growth in our city."

ENGINEER *Philip J. Holten, Jr., Chief Engineer Water Supply Board, Providence, R. I. says—*
"Transite's installation savings have helped us absorb recent increases in labor and material costs . . . Our records show that labor and material costs have increased 100% since 1946. Yet, in this same period of time, our installation costs have increased only 21%. The ease of handling and speed with which contractors can layTransite Pipe enable us to take full advantage of modern equipment and methods. In this way, Transite has played a prominent part in helping us offset increased costs."

CONTRACTOR *C. J. Fanning, Pres. Fanning & Doorley Construction Co., Providence, R. I. says—*
"You soon see why Transite Pressure Pipe saves time and labor when you're working through old, unmarked utility and service lines. These unforeseen obstacles can cause costly slowdowns, but they present fewer problems with Transite. Its flexibility, easy handling and speed of assembly enable our men to work fast even under the most difficult working conditions. And by the same token—your crews really move along when conditions are favorable."

CONTRACTOR *Frederick J. Gallagher, F. J. Gallagher Trenching Co., Tucson, Arizona says—*
"By using Transite Pressure Pipe, we completed this 70,000-ft. water system contract several weeks faster than we had estimated. Transite's ease of assembly keeps our time and labor costs low. We excavate, install the pipe, and button up the trench fast. This speed is especially advantageous when we encounter cross service lines or are faced with bad weather. And always important, it means less annoyance to our own townspeople and the local merchants."

MAYOR *James L. Gardner, Wichita, Kansas says—*
"Every year—we actively go after new business . . . seek new firms to locate in Wichita to create job and business opportunities for our citizens. These new firms need water—and never fail to ask about our water system . . . which is one of the most efficient systems anywhere in the world. Part of its efficiency is made possible by Johns-Manville Transite Pipe which we have been using for many years."

ENGINEER *Leigh O. Gardner, Yost and Gardner, Engineers, Phoenix, Arizona says—*
"Transite has many advantages contributing to its economy. Its light weight, handleability and easy-to-join Ring-Tite Coupling keep our clients' final costs low. We find a continuing economy of operation throughout its long life. We have excavated lengths of Transite after 20 years of service and have found no sign of tuberculation . . . the smooth inside walls proving it still has low coefficient of friction and therefore highest carrying capacity."

NEWS OF ENGINEERS

EDWARD W. ZEIGLER retired June 1 after 35 years with the City of Oakland, Calif. A graduate of the University of Arizona, he served in all classifications of the Oakland Engineering Department, becoming Assistant City Engineer in 1951. During the past eight years, he planned and supervised projects costing more than $30 million. He received the Samuel A. Greeley award for outstanding service to the city in 1951. He is a member of APWA and has been active in local engineering associations.

G. R. HERZIK, Jr., has been appointed Chief of the Division of Sanitary Engineering, Texas State Department of Health, succeeding the late V. M. Ehlers.

JOHN J. HENNIGAN, Jr., formerly Professor of Civil Engineering, Syracuse University, is now associated with the firm of K. G. Woodward & Associates, Consulting Engineers, 13 East Main Street, Webster, New York.

JOHN J. KRAUSE, who retired as Water Superintendent of La-Grange, Ill., on May 1, was the guest of honor at a luncheon given by the Mid-Central Water Plant Operators Ass'n.

Manufacturer's Representative Will Handle Another Account

A manufacturer's representative in the New York, New Jersey and Connecticut area can accept an additional account, preferably a type of valve or allied equipment. He is recommended by the Editor of Public Works. Write Box 6W, this Magazine.

Suppressing Aerator Froth

As a result of investigations made by the Bureau of Sewage Disposal Operation of the New York City Department of Public Works, during the past few years the aerator froth at the Bowery Bay Plant, caused by wash detergents, is being suppressed by a spray system, designed according to criteria developed at the Hunts Point Plant. The system features a corrosion-resistant cement-lined cast iron pipe and fittings with low pressure, large flooding type nozzles applying up to 0.5 gallon per minute of final effluent per lineal foot of aerator. By operating the system at pressures of 10 psi or less, the formation of a finely divided mist of sewage effluent over the area of the aeration tanks has been avoided.

Sanitary Engineer Needed by Consulting Firm

An established and well known firm of consulting engineers in the mid-west needs a sanitary engineer to serve as department head. Good salary and fringe benefits. Write Box 6-2, Public Works, 200 South Broad St., Ridgewood, N. J. Letters will be forwarded without acknowledgment.

Air Pollution Conference

Research findings on air pollution topics ranging from automobile exhausts to atmospheric monitoring will be presented June 22 through 26 when Los Angeles is host to the 52nd annual meeting of the Air Pollution Control Association. Approximately 75 technical papers will be presented during the conference's 15 sessions.

*THE NAME ORANGEBURG AND THE SILVER BAND ARE REGISTERED TRADE-MARKS OF THE ORANGEBURG MANUFACTURING CO.

Over 300 million feet in use coast to coast!

The test of time has proved the high quality of Orangeburg *Root-Proof* Pipe and Fittings for house sewer lines, downspout run-offs and other underground, non-pressure uses.

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FINANCIAL PLANNING

Thank you for sending me a copy of your current issue of PUBLIC WORKS, containing the third of a series of articles by my friend Harry L. Severson, on "Formulating A Financial Plan."

I have seen all of the articles in this series. In my opinion, your magazine has rendered a most useful service in publishing them.

I know of no larger problem in the field of local finance than that of capital expenditures and their financing. Mr. Severson's projections, and his comments on financial planning, are a most useful contribution to literature in this field.

G. G. Tegnell
Director Research Dep't.
N. Y. Chamber of Commerce

Thank you very much for sending us a copy of the April, 1959, issue of PUBLIC WORKS Magazine. We are certainly interested in the article by Mr. Severson on formulating a financial plan for local government. We are also glad to see that PUBLIC WORKS is in the forefront of providing this type of information to its readers.

Alan Beals
Director of Publications
American Municipal Ass'n

I greatly appreciated your kindness in sending me a copy of the April, 1959, issue of PUBLIC WORKS in which an article appears by Harry L. Severson on "Formulating a Financial Plan for Local Government." Mr. Severson has done his customarily good job in presenting major features to be considered in formulating policies to govern a financial plan. I sincerely hope that the article is widely read and that it influences appropriate action to insure sound financial planning. Your efforts, and those of others, should help improve long-term financial planning by local governments.

Joseph F. Clark
Executive Director
Municipal Finance Officers Ass'n.

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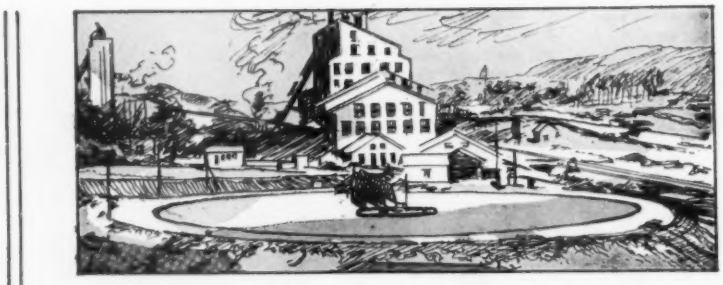


Prepared by **CLAYTON H. BILLINGS,** ***Associate Editor***

Fruit Processing and Domestic Sewage

The Borough of North East, Pa., has 5,000 residents, four fruit processing plants and one milk plant. All of the industries except one discharge wastes into the borough sewer system. The standard filter treatment plant originally built in 1914 and enlarged in 1935, was receiving an organic waste load by 1949 of a 40,000 equivalent population, more than ten times the design capacity. As a result of six years of negotiation between the Borough Council and the industries, agreement was reached in 1955 on plans for financing needed improvements. Pilot plant studies by the consulting engineers led to the conclusion that trickling filters were best able to withstand the high seasonal loadings of the fruit processing industry and that a low pH was the only factor in the waste characteristics which affected the filter detrimentally. The improvements made at the borough plant consisted of constructing a high rate filter to precede and to operate in series with the existing standard filter. Automatic pH control was incorporated in the design. Sampling and measuring stations were established at the industrial plants, and each industry is billed monthly in accordance with a formula based on BOD and solids loading.

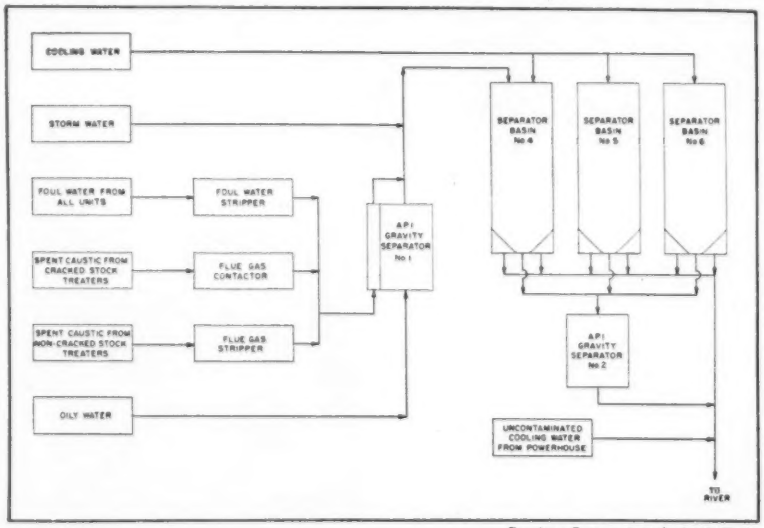
"Sewage Plant Designed to Handle Industrial Wastes." By R. H. Dyment. *Water and Sewage Works*, April, 1959.

Refinery Waste Treatment and Evaluation

In the design of Tidewater's Delaware refinery, pollution of air, water and soil was considered for each individual unit. Adherence to a policy of providing waste treatment facilities as close as possible to the source of each unit waste avoided the difficulty inherent in handling mixtures of contaminants which have been greatly diluted. To prevent soil pollution from oil spillage, nearly all pumps were provided with mechanical seals which reduced pump gland leakage. In addition the ground surrounding the units was covered with concrete pads. Foul smelling waters are handled in closed systems; odorous gases are burned; catalyst dust and coke fines are retained in cyclone separators. Sulfur dioxide disposal is by dispersal through stacks varying in height from 225 ft. to 500 ft.

Cooling water is returned through separating basins for removal of emulsions and oil. The basins are also used for treatment of collected storm water before discharge. Oily water from leakage, spills and equipment drains passes through an API gravity separator and thence to separating basins. Process waste water is collected from the crude unit, fluid catalytic cracker, fluid coker and other operations for pretreatment in a foul-water stripper. Here, stripping with 20,000 lb./hr. of steam maintains an overhead temperature of 190°F and removes sulfides, ammonia, hydrocarbons, phenols and acid oils. Spent caustic from treating straight-run stocks is processed in a flue-gas stripper, where carbon dioxide releases hydrogen sulfide for burning. The spent caustic from treating cracked stocks contains phenols and acid oils in addition to sulfides and mercaptides. These are stripped from the caustic with flue gas in a batch still. Waste water from the flue gas stripper is sent through an API separator and then to the large separating basins.

During the plant construction period in 1956, an extensive sanitary quality study was made of the lower Delaware Bay estuary to establish a base line of water quality. Stream and estuary sampling was carried out during slackwater conditions in establishing the base line and in subsequent evaluation of waste treatment measures. Estimates were made, in advance of refinery completion, of anticipated



Courtesy Sewage & Industrial Wastes

● **FLOWSHEET for waste treatment system of Tidewater Oil's Delaware refinery.**

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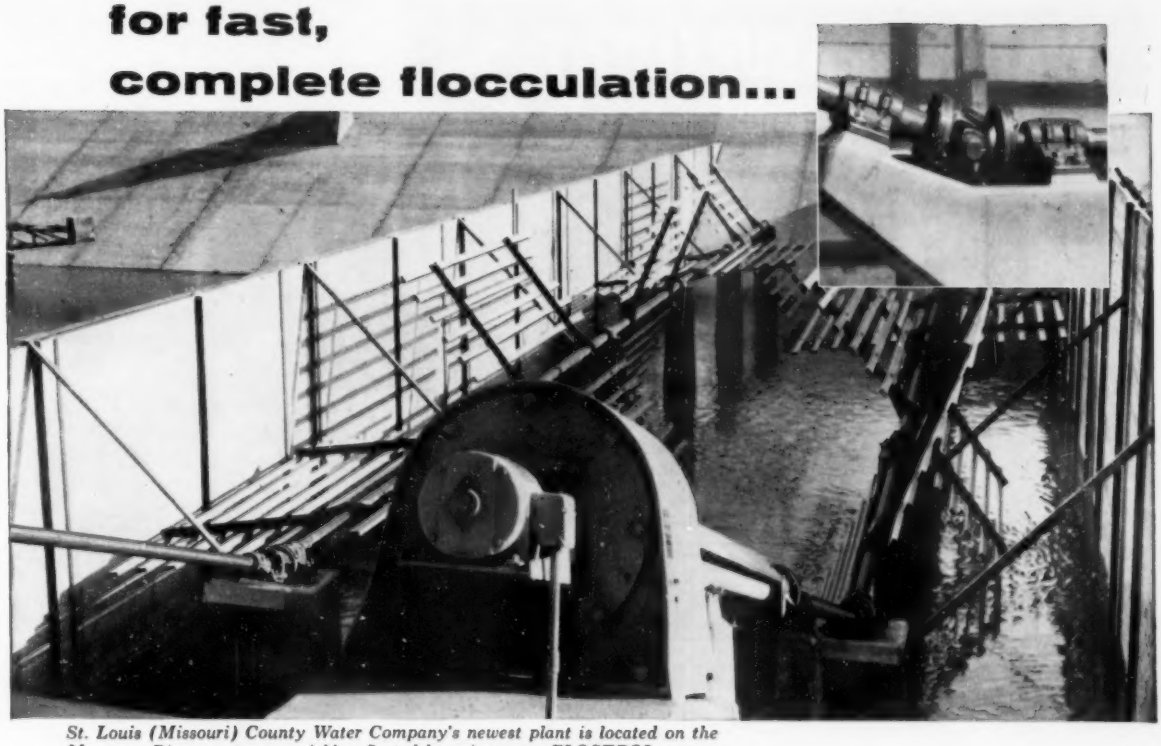

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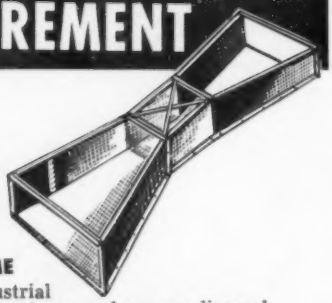

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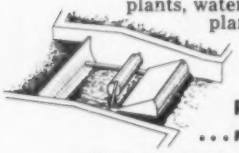

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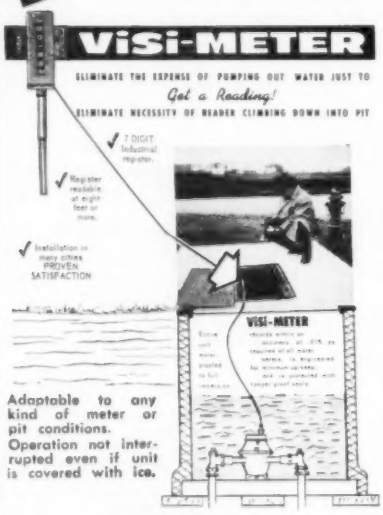
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effluent concentrations and maximum permissible concentrations were established for sulfides, ammonia, cyanides, phenolic compounds, hydrocarbons and total oils. After a year of operation, it was shown that operating results were in agreement with anticipated values of waste concentrations, that maximum tolerance levels were not exceeded, and that the treated waste did not alter estuarine water quality.

"Tidewater's Delaware Refinery Waste Control and Treatment." Part I on facilities and treatment methods by A. W. Lewis; part II on evaluation of treatment by A. J. Kaplovsky. *Sewage and Industrial Wastes*, April, 1959.

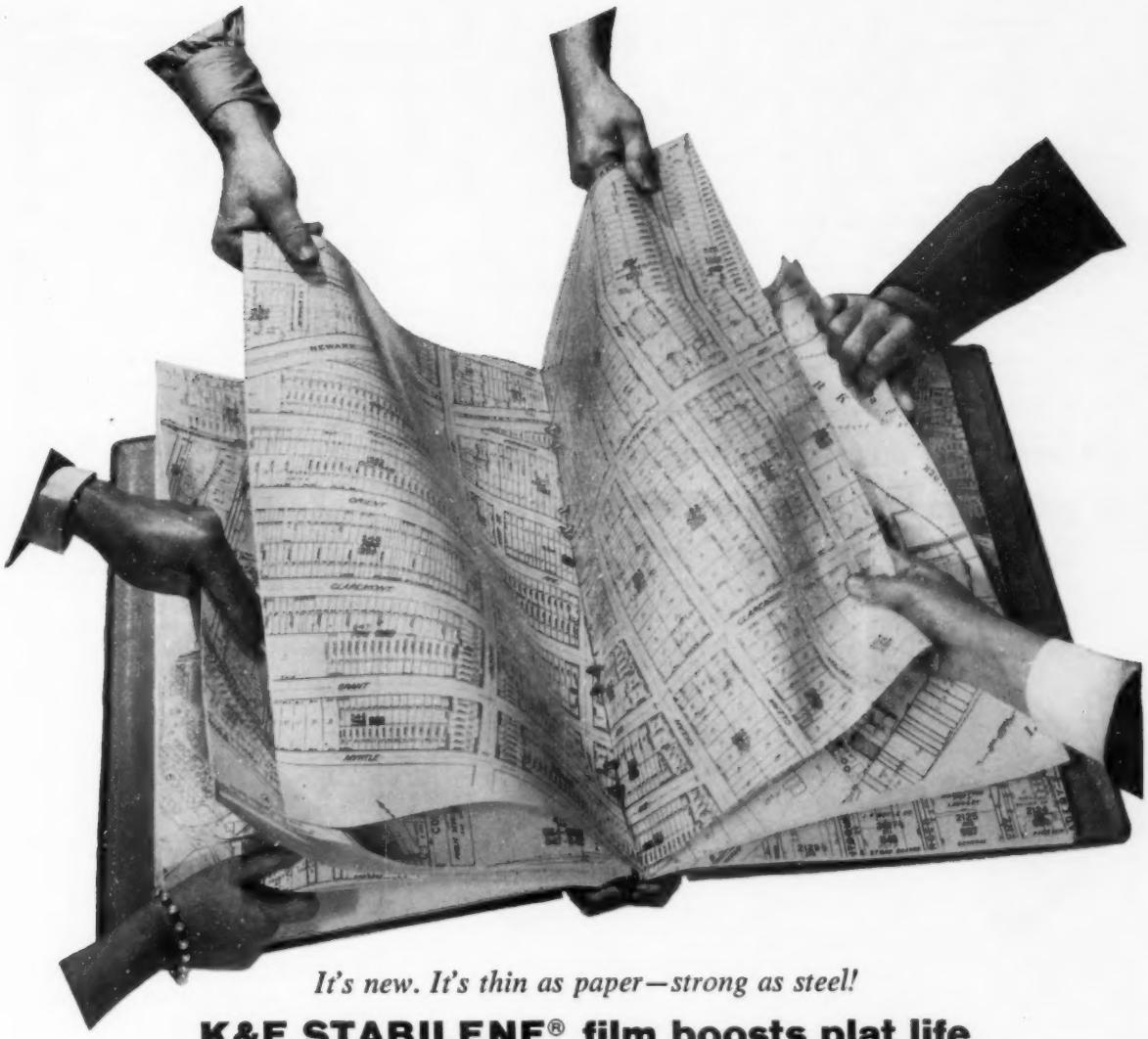
Plating Waste and Activated Sludge

At Fairfield, Conn., 20 industries use the sanitary sewer system. For five years prior to March, 1957, the only evidence of the industrial waste load on the activated sludge plant was an occasional slug of acid. Then a new chromium plating firm started discharging rinse waters to the sewer system without notification. The total discharge was 192,000 gallons per day, about 10 percent of the total sewage flow at the time. The hexavalent chromium concentration in the primary settling tank was 7 mg/L. The effect on the plant, aside from coloration of the sewage was to reduce the activated sludge to a pin-point floc which failed to settle. BOD removals dropped from 95 to 70 percent and suspended solids removals, from 96 to 78 percent. The problem was relieved satisfactorily by changing the rinse method at the plating plant and correcting the pH of the waste. In addition, drip trays were installed for drainage of plated castings and the drained solutions were returned to the chromium solution tanks. The changes resulted in savings by the firm and a reduction in waste volume.

"Effects of Chromium Wastes on Activated Sludge." By S. A. Stankey. *Sewage and Industrial Wastes*, April, 1959.

Field Method for Dissolved Oxygen

Difficulty is encountered in the dissolved oxygen determination of waste effluents and streams, because the tests must be conducted in the field and quantitative chemical analyses are not readily adaptable to field use. Conventional portable instruments using dropping mercury electrodes are not practical for this work because motion



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causes unsteadiness in the flow of current. An apparatus for polarographic reduction of dissolved oxygen at a dropping mercury electrode, using a drop time of 0.25 second, was developed. The rapid drop produced a current insensitive to motion. This feature was achieved by mounting the dropping mercury electrode horizontally in the electrolytic cell and by adjustment of capillary conditions. The apparatus is inexpensive and simple enough to be operated in a small boat. It is applicable to water samples within a pH range of 4.5 to 11 and at salt concentrations between 0.001 and 0.05 *M*. Two small dry cells are used to provide the reference voltage and the circuit is so arranged that the microammeter can also serve as the voltmeter.

"Portable Analyzer for Determination of Dissolved Oxygen in Water." By C. P. Tyler and J. H. Karchman, *Analytical Chemistry*, April, 1959.

Solids Balance in Whey Waste Aeration

Previous investigation of the treatment of whey waste by aeration showed a sludge accumulation with the treatment of 1000 mg/L of whey in the presence of 2,000 mg/L of sludge and that the waste is successfully oxidized without the aid of nitrogen supplements. Further studies were undertaken in an effort to establish a COD and solids balance to clarify the data. Two aerators were kept in operation for 96 days. One received natural whey without supplement; the other received the same whey plus ammonia. Aeration was by means of a turbine type agitator. After 35 days, sludge accumulation was observed and solids appeared in both effluents. These were recovered and analyzed to compute a COD and solids balance. An average of 75 percent of the influent whey was oxidized; with removal of sludge from the effluent, purification to the extent of 97 percent is possible. Although sludge oxidation occurred, sludge accumulation was evident. Nitrogen supplementation of the whey waste offered no advantages in the method of treatment used. Calculations indicate that a dynamic equilibrium is possible when 100 units of sludge are used to treat 10 units of whey, based on a 6.3 percent per day sludge oxidation rate.

"Aeration of Whey Wastes II. A COD and Solids Balance." By Nandor Porges and Lenore Jasewicz. *Sewage and Industrial Wastes*, April. 1959.

• • •

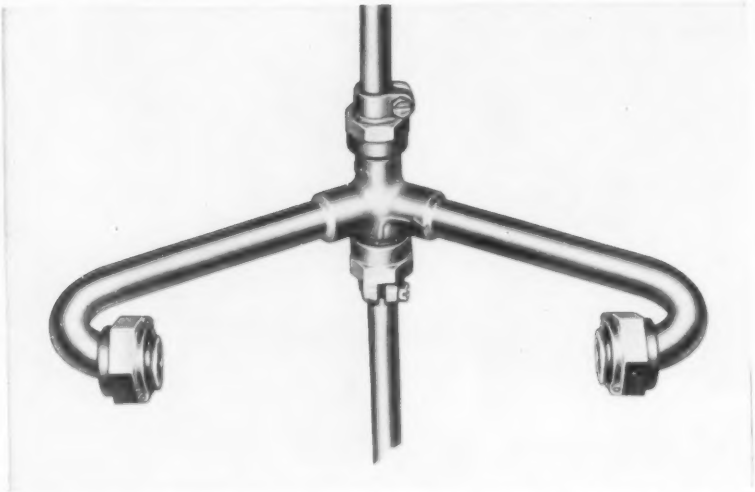
Assessments for Resurfacing Streets

The United States Supreme Court recently refused to rule on protests by a group of Miami property owners against assessments made by the city for resurfacing streets. The property owners claimed that the streets were originally paved at the expense of the abutting owners. Resurfacing, made necessary by heavy traffic, was of no special benefit to them but benefited the general public, they contended.

In cases presented to the Florida Courts, they asked that the assessments be declared void because resurfacing did not benefit their properties, the assessments were made without proper notice, and resulting liens violated the guarantee of due process and equal protection of laws.

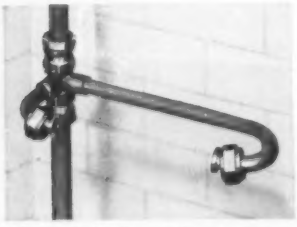
The Florida Supreme Court ruled against the property owners, holding that the city had power to place the liens, notices of the lien proceedings published in the Miami newspapers were valid, and the property owners could not question the assessments because they had failed promptly to assert their rights.

NO basement meter mounting can be installed as quickly and easily as Ford's "HANDYHORN"!



The new Ford HANDYHORN (above) eliminates pipe threading, flaring and soldering, puts meter right side up, and provides a permanent physical and electrical connection of the service even when the meter is removed.

Quickest and simplest means of setting meters in basements, the HANDYHORN can be installed with saw and wrench. It can be used in nearly all vertical piping. Tubes are set at an angle of 120° to permit installation in corners where pipe is at least 2″ from wall surfaces.



Where piping is too close to corner . . . the Ford KORNERHORN can be employed. Like the HANDYHORN, this mount does not require flaring or soldering . . . and is quick and easy to install.

Convenient, durable and attractive, the HANDYHORN is the modern way to mount water meters . . . reduce installation costs.

For more information, write . . .

FORD

FOR BETTER WATER SERVICES

THE FORD METER BOX COMPANY, INC. Wabash, Indiana

"DO IT NOW!"

but make sure you don't have to do it again!

Specify Permanent **CAST IRON PIPE** *for Water and Sewer Mains*

AWWA National Survey Shows:

- Twenty per cent of the systems are deficient in supplies of available water...
- Forty per cent need more transmission facilities...
- Thirty per cent are short of pumping capacity...
- Forty per cent require greater treatment capacities and better treatment methods...
- Thirty per cent are deficient in ground storage capacities...
- Forty per cent need more elevated distribution storage...
- Sixty per cent must provide bigger and better distribution systems.

Appeal of the AWWA to American communities to "Do It Now" in speeding up improvements of water systems brought good results in 1958. This year many more communities are launching water works and sewer improvement and expansion programs to provide for increased future water needs.

When your community develops its water system, make sure you don't have to "do it again" 10 or 15 years from now.

Only permanent Cast Iron Pipe can provide this assurance. Its record of long life — a century or more — and its minimum maintenance cost have never been matched by any other pipe ever made. That's why it has long been known as "America's No. 1 Tax Saver."

Our Company does not manufacture pipe, but supplies the nation's leading Cast Iron Pipe manufacturers with quality iron from which quality pipe is made.

WOODWARD IRON COMPANY

Since 1882

WOODWARD, ALABAMA

INFILCO Representatives to serve

PHONE THE ONE NEAREST YOU FOR INFORMATION

regarding water, sewage and waste treatment, whether for a new installation, or for modernization and expansion of an existing plant.

You will benefit by using the facilities of an organization with more than 60 years of experience.

Specialists in each type of treatment together with the services of an extensive research and development department are ready to serve you and your Consulting Engineer. Use them to obtain *PLUS* values—superior performance and savings in installation and operation.

INFILCO offers a complete line of proven equipment for:

Clarification	Aeration
Softening	Flotation
Filtration	Comminution
Ion Exchange	Biological Treatment

Atomized Drying and Incineration

INFILCO

INFILCO INC.
General Offices
Tucson, Arizona

you...and your Consulting Engineer!

MUNICIPAL PARKING LOT FEATURES AUTOMATIC TOLL COLLECTION

RECENTLY opened to the public in New York City's borough of Queens, the new Rego Park Municipal Parking Lot can accommodate 1150 cars. Located a block and one-half from the subway, the new off-street parking field puts Long Island commuters and shoppers only 26 minutes from Times Square. A special feature of the lot is an automatic traffic and revenue control system, which was designed and manufactured by Taller & Cooper, Inc., Brooklyn, N. Y., a subsidiary of American Electronics, Inc.

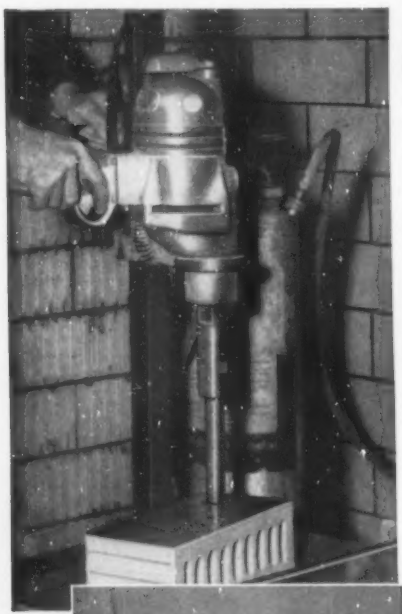
The new $1,160,000 Rego Park Municipal Parking Field is the ninth self-liquidating facility built under the Department of Traffic's $94,000,000 program to provide 40,000 off-street parking spaces within six years. In addition, it represents the City's first lot equipped with electromechanical controls and counters for efficient, automatic control of parking using a minimum number of personnel.

One section of the parking field, intended to serve motorists parking on an hourly basis, has meter-equipped spaces for 290 cars. Rates are 10 cents an hour or 35 cents for twelve hours. A larger area, with spaces for 860 cars, takes care of all-day parking. Here there is a flat charge of 35 cents for twelve hours or less.

The toll-collecting area for the larger field consists of three lanes. The lanes may be arranged to permit entry or exit as traffic conditions require. Treadle-activated counters record cars entering and leaving the field and activate the semaphore-type barrier gates. Integrated with the treadle system at the "exact change" entrance is a Taller & Cooper "Toll-O-Mat" automatic toll collector cabinet.

A motorist drives up to the "exact change" entrance and tosses his money into the basket. Any combination of coins equal to, or greater than, the correct fee causes the traffic signal to change from red to green and opens the gate to allow the vehicle to proceed. After the rear axle of the vehicle crosses the treadle, the gate automatically closes behind the entering car.

If a car crosses the treadle without depositing the proper fee, however, the traffic light remains red, and a violation alarm is set off. A yellow light atop the standard 8-foot stanchion flashes, accompanied by a loud bell, to signal the violation.



TRUCO® does it again!

BIG SAVINGS in tile installation

JOB: Cutting 3500 holes 1", 1½", 2" and 2½" dia. through structural glazed and facing tile to admit plumbing pipes in walls of kitchens and washrooms in Ford Motor Company's Staff and Product Engineering Buildings, Dearborn, Michigan.

CONTRACTOR: Smith Fireproofing Company, Detroit.

TOOLS: Truco Hand Swivel Drill Motor, a heavy duty unit operating at 1000 rpm with integral Truco Water Swivel and Truco Drill Stand mounted on a wheeled platform, readily movable to each work site.

OPERATION: The previous method required a sawing operation in a separate room to which tile was carried at considerable cost in man-hours. Much chippage, scrap, waste and dirt resulted. Pieces of tile had to be patched in around pipes, taking more time and leaving an unsightly job. With Truco equipment right at the work site, tile was placed on a board, holes drilled in less than three minutes per hole, and the tile laid up in the wall. Holes were accurate, fitted neatly, and there was no unsightly patching, no chippage, practically no scrap or litter. Truco equipment delivered a perfect job at a fraction of previous cost.

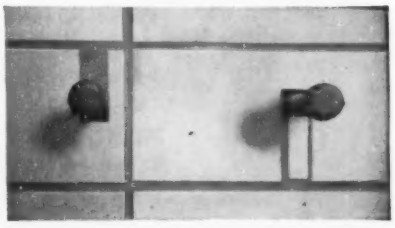
Write or phone for nearest distributor's name.

TRUCO MASONRY DRILLING DIVISION
WHEEL TRUEING TOOL COMPANY
83-3200 W. Davison Ave. • Detroit 38, Michigan

Top, left: Drilling accurate holes for plumbing in glazed structural tile averages less than 3 minutes per hole with Truco diamond drilling equipment.

Bottom, left: Finished holes are neat, clean, accurate, and need no patching.

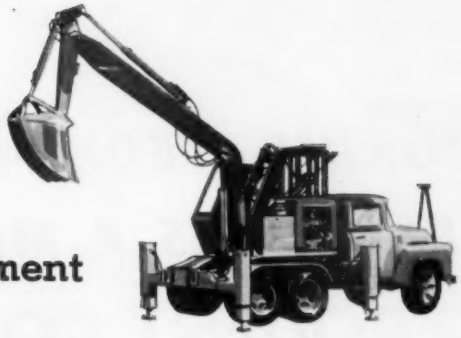
Bottom, right: Old method involved sawing slots which required patching, and left unsightly wall scars.



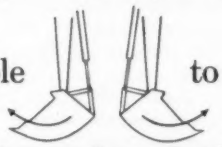
This is a

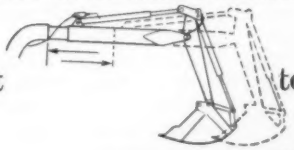
HYDROCRANE

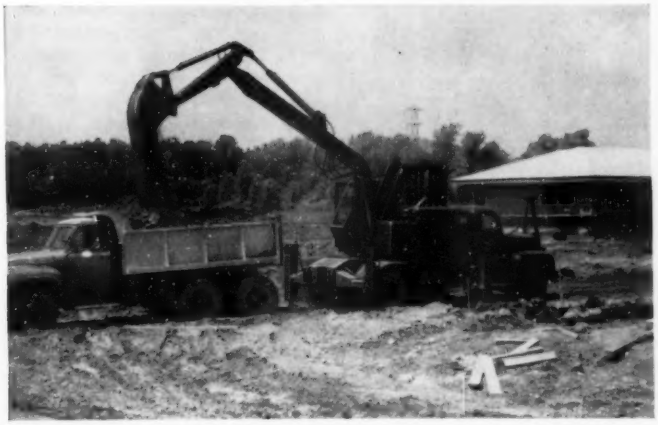
...with a Hydrohoe attachment



and you can bet it's going to DIG because behind the teeth on that bucket is a combined total of 189,000 pounds of ram force! This machine has a combination of features that put it in a class by itself among half-yard hoes.

Here's why: The dippers for Hydrohoes, ranging from 24 to 60 inches wide, are reversible  to give you two-way digging action.

Also, the dippers have hydraulic wrist action to bite in fast and hard. The boom on this hoe telescopes 4 feet  to give you efficient dumping reach for every job, eliminating unnecessary move-up time.



Who uses them? Municipalities, counties, utility companies, excavating and sewer contractors. Your distributor is ready to show you how they'll work *on your jobs.* Call him today, or write Dept. 14H59A, Bucyrus-Erie Company, South Milwaukee, Wisconsin.

BUCYRUS ERIE®

Builds Better Equipment

COORDINATED EFFORT PRODUCES A MODEL RODENT CONTROL PROGRAM

A COMMON cause has united the merchants, industry and city health officers, as well as the Chamber of Commerce of Marshall, Texas since 1945. It started when the citizens became alarmed at the serious rat problem in their community. A semi-annual rodent control campaign was apparently mitigating the problem, but by no means solving it. The six-month interval between campaigns permitted rodent survivors to multiply quickly and to reinfest the area.

The rodents were of 3 principal kinds—field mice, the climbing Alexandrian rat, and the vicious Norway rat (alias wharf rat, brown rat, sewer rat, barn rat). They were infesting the commercial sections of Marshall and had migrated to a dangerous extent to the residential areas as well. While practically all commercial establishments were rat harborages, the infestation was most serious in old buildings and in the wholesale district near the railroad shops.

In 1945 a wholesale grocer lost half a ton of sugar, rice and other foods contaminated by rat filth and accordingly condemned. A large feed mill in Marshall estimated its annual losses conservatively at about $2,000. Retail stores figured that each was paying $300 to $600 a year in tribute to their rats.

Rat-borne typhus fever was endemic in Marshall, as it was in other areas in Texas in 1945. In that year, Marshall had lost one human life to the disease, and four others had been stricken. The two previous years had been similarly severe.

With their patience exhausted, a committee of Marshall businessmen made urgent inquiry of the U. S. Fish and Wildlife Service in San Antonio requesting their recommendations as to the establishment of a permanent rat control campaign. Dewey Kennedy, Senior District Field Assistant of the Service offered his own assistance and the full cooperation of his organization.

Several planning meetings were called among a dozen or so of the city's leading businessmen. It was calculated that an effective campaign would require a budget of $3,600, and that this same amount would be needed each year if a permanent program were to be sustained. It was pointed out that the value of a rodent control project might be quickly erased if community vigilance were ever relaxed.

Committees called on businessmen throughout the city to solicit funds, and the $3,600 was raised. Subscriptions from merchants and manufacturers ranged from $6 per year for a small establishment to $300 per year for a larger one. In the first year, 180 businessmen subscribed.

For administrative and legal reasons, the Marshall Rodent Control Association was incorporated as a non-profit civic enterprise "to plan, finance, maintain, and conduct a permanent project for the eradication of rats . . . from the industrial, commercial and residential areas of the city of Marshall, Texas and the rural areas of Harrison County, Texas, through the establishment, maintenance and operation of a poisoning plan under the direction of the Fish and Wildlife Service of the U. S. Department of the Interior and the State Extension Service at Texas A & M College. . ."

A local resident, Drue Moore, was trained by Mr. Kennedy and was employed on a permanent basis to make inspections throughout the city and to effect whatever control measures were deemed advisable.

The program was launched in October, 1945. It was decided to treat all places of business in the city regardless of whether or not they subscribed to the fund.

From the very beginning it was an active, aggressive program in which rat infestations were searched out and destroyed, and routes of immigration, when found, were blocked. There was no waiting for complaints to be reported. The records show that about 1,300 individual visits were made to places of business each year, and 370 to resi-

● **INSPECTION for evidences of rat harborage plus routine baiting provide insurance against reinfestation. Here Drue Moore applies bait and checks a drain pipe while Philip Maranto, Chairman of Marshall's Rodent Control Association, looks on.**

AMERICAN *Fastite*** JOINT* CAST IRON PIPE

From its plant location in the heart of the industrial South, as well as from strategically located stocks, the American Cast Iron Pipe Company ships pipe fast!

More and more, municipalities, contractors, engineers and utility superintendents are discovering that American's fast service, plus the speed and ease of installation of American Fastite Joint* pipe, is a combination that's hard to beat.

American Fastite Joint is the newest cast iron pipe joint with only *one* component—a double-sealing, dual-hardness rubber gasket. Readily available in all standard sizes, 2″ through 48″ diameters, with 6″ through 20″ pipe available in 20-foot lengths, American Fastite Joint cast iron pipe offers maximum economies for all liquid services.

Call your American Cast Iron Pipe Company representative now. Find out how quickly he can deliver your order for American Fastite Joint cast iron pipe.

*Patent applied for.
Underwriters' Laboratories, Inc., approved.

See Booths 81-82
Annual AWWA
Conference
San Francisco
July 12-17

AMERICAN
CAST IRON PIPE CO.
BIRMINGHAM ALABAMA

SALES OFFICES
New York City • Dallas
Chicago • Kansas City
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Pittsburgh • Orlando
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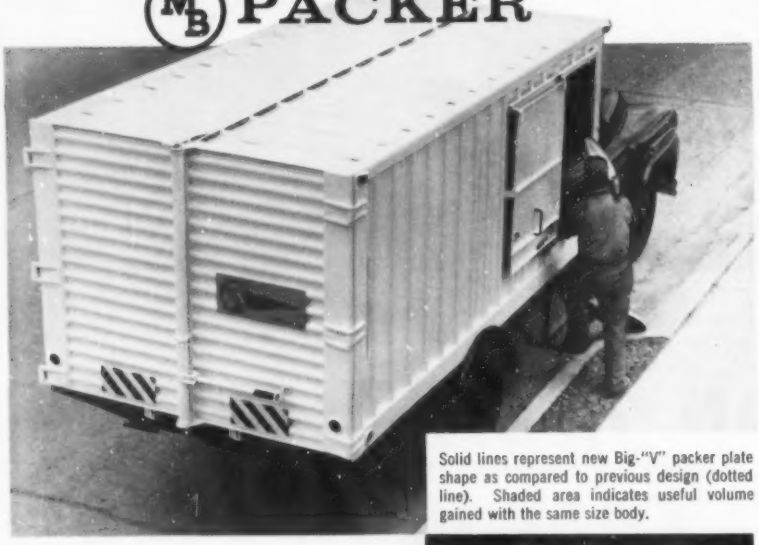
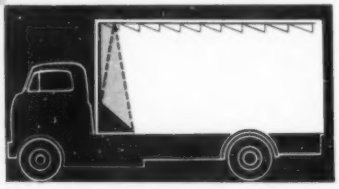
NOW...more capacity in the new Big-"V" model M-B PACKER



Solid lines represent new Big-"V" packer plate shape as compared to previous design (dotted line). Shaded area indicates useful volume gained with the same size body.



NEW PACKER PLATE DESIGN ADDS 4 CU. YDS. CAPACITY

See how the new Big-"V" models give you BIG VOLUME—more useable *inside* capacity as well as fully-rated *compacted* volume. Because of the new vertical packer blade design, the plate is flush with the front of the body during loading, giving you up to 4 cu. yds. of useable area above the rated compacted capacity of the body! Look at the chart below for a dramatic comparison of the new total *useable* capacity and the rated capacity.

Rated Capacity — cu. yds. (Actual Compacted Volume)	14	16	20	24
Total Inside Capacity — cu. yds. (Actual Compacted Volume including Loading Area)	18	20	24	28

NEW Because of the new blade shape, the load is compacted *upward* with greater force to provide a tighter "pack" at the top of the load. And you get better load distribution on the truck chassis with the center of the load moved forward.

NEW A double row of 8" "shark's teeth" mounted in the top of the Big-"V" model increases retention of refuse and density of the load. By preventing "fall-back" of material, the load stays put . . . tightly packed.

NEW Sturdy fold-out steps beneath each side loading door provide greater standing room—easier loading. Steps quickly flip in or out, as needed.

Combine these features of the new Model Big-"V" with the most efficient, simple power train and packing method developed, and you have a modern compaction body that beats any comparison! Ask your distributor for a demonstration soon, or write the M-B Corporation, New Holstein, Wis.

QUALITY MUNICIPAL AND INDUSTRIAL EQUIPMENT SINCE 1907

M-B CORPORATION

LINE MARKERS PACKER BODIES SWEEPERS

dences for inspection of vents, sidewalk gratings, storage places, basements, attics and dumping places. Recommendations were made for sanitary improvement and removal of rat harborages. He was responsible for about 38,000 bait placements annually, most of them in more recent years for preventive purposes.

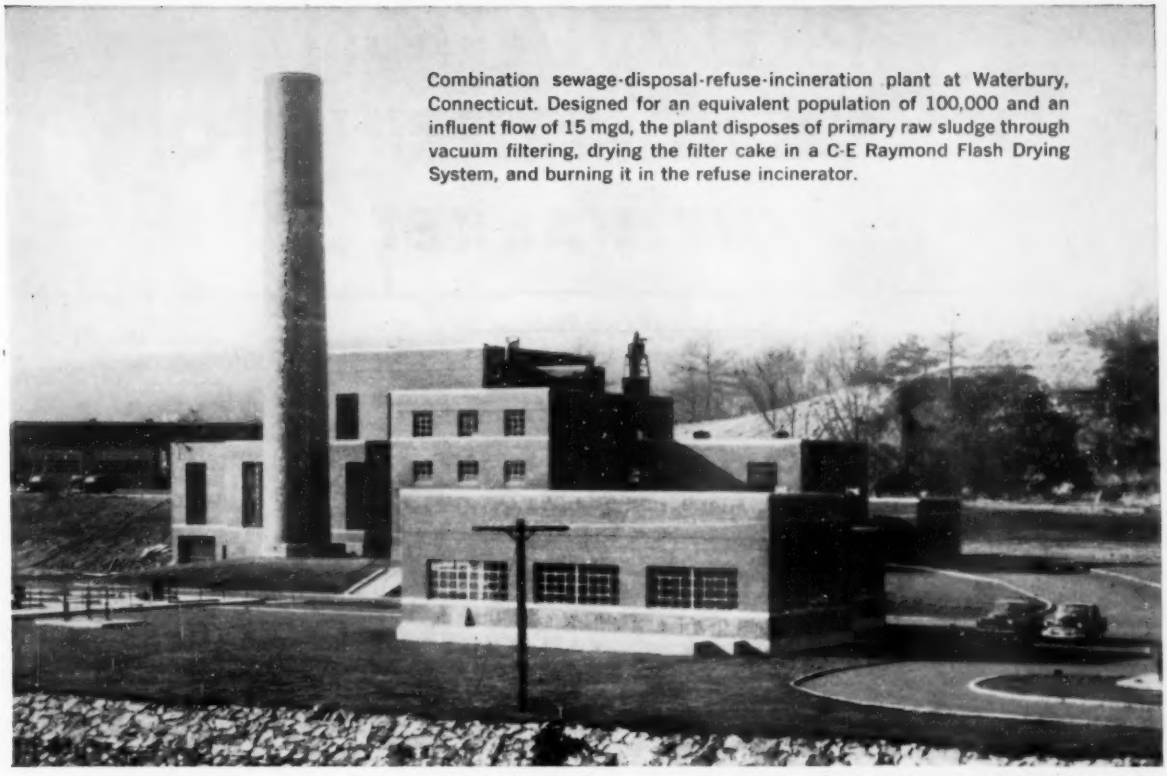
Since October 1945, the Board of Directors of the Marshall Rodent Control Association has remained virtually intact. The only changes have been due to death or change of residence. Chairman Philip Maranto is keenly interested in the program and has the knack of inspiring his colleagues and fellow townspeople with the importance of the task. Today the program is conducted efficiently and routinely as a necessary part of community life.

A number of poisons were used, including sodium fluoracetate (also known as 1080), warfarin or Compound 42, red squill and thallium sulfate. They have varying degrees of toxicity and each has its place. Those most toxic to humans could not be applied except under strict control. The anticoagulant Warfarin was made available in 1950 and could be employed with a minimum of danger. When this compound was first used, baits were made up with cornmeal and mineral oil. After a few months, a more effective combination was used, consisting of Warfarin, cornmeal, rolled oats, powdered sugar and peanut oil. Since 1952, pival, fumarin and some P. M. P. have been used with this formula.

The City of Marshall and its Rodent Control Association have received frequent visits from Government experts and representatives of the Texas A & M College since the program was initiated.

Since 1945, inflation has affected Marshall's rat control campaign to the tune of about 33 percent. The annual budget has been increased to $4,800, but no one has complained about the expense. The results have been too favorable. To date there have been no financial problems.

It is estimated that Marshall is as nearly rat-free as possible in a community of its kind, and not a single case of typhus fever has occurred there since 1945. The Fall season of 1958 was considered a peak year for rats throughout the Southwest, and many cities were seriously threatened with rodent invasions. Marshall's rat population has remained at a low level, although the outside rodent pressures have greatly increased.



Combination sewage-disposal-refuse-incineration plant at Waterbury, Connecticut. Designed for an equivalent population of 100,000 and an influent flow of 15 mgd, the plant disposes of primary raw sludge through vacuum filtering, drying the filter cake in a C-E Raymond Flash Drying System, and burning it in the refuse incinerator.

Consultants: Malcolm Pirnie Engineers, New York City

At Waterbury, Connecticut . . .

C-E RAYMOND FLASH DRYING SYSTEM DRAMATICALLY EXCEEDS CAPACITY GUARANTEES

- *By 70% for quantity of filter cake handled*
- *By 45% for moisture evaporated*
- *By 66% for dry solids produced*

The C-E Raymond Flash Drying System has consistently exceeded capacity guarantees at Waterbury. There were many reasons for the selection of the Raymond System other than the proven, built-in, plus-performance typical of this equipment. One of these is its ability to utilize no-cost Btu's of hot gases from batch-fed refuse incinerators for drying filter cake.

Waterbury's modern sewage disposal facilities, placed in operation in 1951, were built in conjunction with mixed refuse incinerators. It had been planned that flash-dried sludge would be used for soil conditioner, but the sewage influent contained industrial wastes and heavy concentrations of grease which rendered the product unsuitable for such use. It was then decided to burn the dried sludge. But, disposing of sewage sludge in a refuse incinerator requires effective moisture removal so that the material will burn – a requirement easily met by the C-E Raymond System – as proved by the performance figures.

The Waterbury record proves how efficient utilization of *proper* equipment, conservatively designed, together with excellent operation by plant personnel, can reduce significantly sewage sludge disposal costs.

The Raymond System is available either for use with refuse incineration as at Waterbury, or as a completely integrated unit to dry and/or incinerate *any* quantity of sludge, separately or concurrently.

For details, contact your nearest C-E office. Our specialists will be glad to discuss, with you or your consultants, how this system can benefit your community.

COMBUSTION ENGINEERING

RAYMOND DIVISION 1132 West Blackhawk Street, Chicago 22, Illinois

C-207

Eastern Office: 200 Madison Avenue, New York 16, N. Y. • Western Office: 510 West Sixth Street, Los Angeles 14, Calif.

Canada: Combustion Engineering-Superheater Ltd.

ALSO FLASH DRYING AND INCINERATION FOR INDUSTRIAL WASTE DISPOSAL

PREPARATION OF A BOND OFFERING FOR THE MARKET

HARRY L. SEVERSON,
Financial Economist and
Bond Analyst

THE CAPITAL market is so fluid that success of a financial plan for a local government depends as much upon the efficiency and astuteness with which it is administered as upon the soundness with which it was conceived. Each bond offering must be tailored to meet the realities of the existing situation, if the best price is to be realized. It is well to recognize at the outset that rigid rules (either in the form of laws or self imposed regulations) concerning the issuance of bonds are very likely to work to the disadvantage of the issuer. At this final stage of financial planning the temptation is likely to be particularly strong to temporize with immediate problems rather than to start a new program, the benefits of which seem so far in the future.

The proper preparation of a bond offering for the market involves many technical details. The emphasis in the previous article* on the significant contribution which a financial plan can make to the orderly and efficient expansion of an area should not be allowed to detract from the importance of the careful preparation of each issue. Quite the contrary was intended. The same forces which have made financial planning so necessary, have added to the difficulties of preparing a new offering for the market. These heavier responsibilities in connection with long term financing are coming at the very time that the financial officials are engrossed with the problems involved in expanding their operations to meet a heavier volume of day to day business.

Tax exempt investments are no longer scarce, and as a result the bargaining position of the issuers of State and local government bonds has worsened in recent years. As the flow of new issues has increased, and the total volume of debt of these governments has mounted, the market value of tax exemption has declined. Even more significant is the prospect that this process will continue, except as new markets may be developed. As would be expected, investors have become very selective and weaknesses in an offering, real or fancied, are apt to result in a decidedly lower price.

The rapid changes constantly taking place in the capital market make it imperative that the offering be prepared promptly, once the decision to bring it out has been made; otherwise the offering may come to a market quite different from the one for which it was prepared. Many individuals are involved in preparing the offering, and it is not always easy to coordinate the last minute decisions. Advance planning, however, can make this period somewhat less hectic than would otherwise be the case. The clearing of the financial plan, for example, should have created an atmosphere of which sound decisions can be made quickly. The views of the various interested parties about the form of the new offering can be exchanged in a preliminary way in advance of the actual preparation of the request for bids. As a part of advance planning, an outline of the new offering can be made, and this can be used as a point of departure. It may be well to draft tentative covenants in advance, and in certain circumstances it may even be feasible to stock pile alternative covenants. The poorest way of meeting the pressures of this period is to scurry around for copies of old indentures, a pair of shears, and a paste pot.

Each case is different, and it is not possible to point out in advance precisely which problems will prove to be the most difficult. There are, however, certain questions which necessarily arise when an offering is being prepared for the market. When should it be brought out? What security will be offered? What will be the maturity schedule? Should a call provision be included? If so, what type? Also, at this point it is well to emphasize again that the bid may be affected materially by the astuteness with which the many technical details are handled. Mistakes have an unfortunate way of accumulating, and high borrowing costs may be the result of a series of unfortunate decisions—no one of which appears to be significant.

Timing of an Offering

To a considerable extent the timing of new offerings is determined by the requirements for funds to finance the construction program, but some leeway is highly desirable. If the municipal market appears unfavorable at the moment, it may be feasible to use bank loans in the early stages of construction, thus postponing the permanent financing. This, however, should be done only after careful consideration of the risks involved, since there may be a possibility that the interest rate may go higher. Also during the periods of tight money it may be desirable to reduce the size of the offerings even though this means coming to the market more often. If the market appears favorable, it may be appropriate to bring out a large offering at the outset and invest the excess funds in short term securities until needed.

The use of this leeway in the timing of new bond offerings often presents perplexing problems for local officials. The market is very sensitive, and there are widely diverse factors operating in the municipal market, often resulting in a confused picture difficult for even a specialist to interpret. Since the forecasts of this market must necessarily be taken with reservations, there is a temptation for public officials to argue that they may as well forget the whole problem and bring out the new offerings when it is convenient. The danger in this line of

*"Formulating a Financial Plan for Local Government," PUBLIC WORKS, April, 1959.

We're pulling into the
AWWA Convention in
San Francisco July 12-17. A warm welcome
awaits you in Booths 101 and 102.

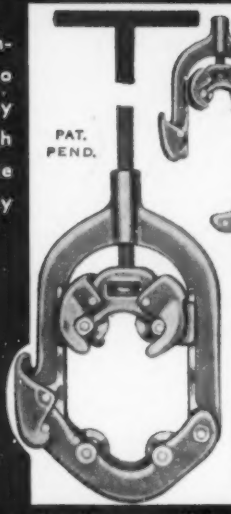
R. D. WOOD COMPANY

Public Ledger Building, Independence Square
Philadelphia 5, Pa.

Manufacturers of fire hydrants, gate valves, and cast-iron pipe

IF YOU CUT LARGE DIAMETER PIPE . . .
YOU NEED THESE
New REED HINGED 4-WHEEL PIPE CUTTERS
Four sizes cover the range from 2½" to 12"

Users tell us these completely new cutters are so efficient they often "pay for themselves" through the savings in crew time on a half-dozen cuts. They are the first really practical tools for cutting off steel or cast iron pipe in sizes from 2½" to 12". You can, for example, cut 8" steel pipe completely off in less than five minutes.



Four wheel design requires minimum swing of handle—less digging in ditch work, easier "tight-corner" cuts.

Closed frame permits light weight with complete rigidity for better cutting.

4-point guide aligns the cutter on the pipe . . . assures perfect tracking and a right angle cut.

Reed Razor Blade wheels track perfectly, cut easily and roll down burr on steel pipe.

Unconditionally guaranteed to be the most efficient cutter you have ever used. Ask your jobber or write for literature.

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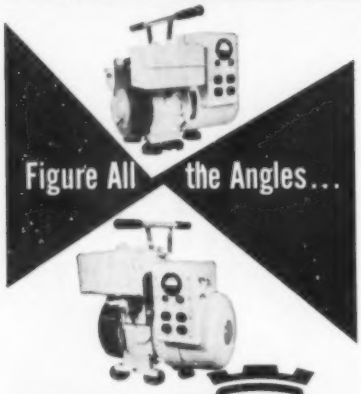

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reasoning is that the penalty for being wrong is likely to be very high, since the swings are often quite great, and even a few basis points amount to a large sum of money over the life of a long term bond issue. The wiser public officials, therefore, realize that they should seek competent professional advice on this important point.

There are a number of problems involved in selecting the exact day for the offering, the happy solution to which may result in a considerably better bid, or perhaps it would be more accurate to say that an unfortunate solution will result in a much poorer bid. An effort should be made, for example, to avoid a day when the calendar is particularly heavy. It is also well to avoid a time when the floating supply of this particular type of issue is especially large, or when there are a number of other issues from the same geographical area. There is the danger of selecting a day which would have been good if a number of other prospective issuers had not come to the same conclusion almost simultaneously.

Competitive Bidding Versus Negotiated Deals

Competitive bidding has become so much the accepted practice for the sale of new issues, that exceptions call for an explanation. Extremely large offerings and special situations are often sold as negotiated deals. From the viewpoint of local officials the chief advantage of competitive bidding is that to a considerable extent it shields them from the criticism of favoritism in the selection of an underwriter. Also the gross spread may be less when there is competitive bidding than when the deal is negotiated, but this may not be a real economy since the underwriter very often performs additional services in the case of a negotiated deal.

In this connection it should be observed that the "dealing at arms length" involved in competitive bidding places the responsibility for tailoring the offering to the wishes of the market and for building investor acceptance squarely upon the issuer. The low profit margin on which underwriters typically operate — somewhere around $12 per thousand dollar bond when there is competitive bidding— makes it necessary for them to depend upon rapid turnover. In only a limited way are they in a position to build demand for a particular issue. Un-

derwriters are often forced to prepare their bids under pressure, consequently it is important that the statements prepared for their use be in such form that the salient information can be abstracted readily. When there are many offerings in the market and the time pressures are heavy, there is an understandable tendency to resolve doubts against the issuer.

As already indicated, unusual deals are sometimes negotiated. In the case of an extremely large offering, there may be no other choice since there is not enough underwriting strength available to make it feasible to organize competing groups. If it becomes necessary to sell an offering in a period of very tight money, a negotiated deal may be indicated. Also in the case of a new form of security which requires special study and the development of new markets, a negotiated deal may be the best practical solution. Since it is generally known that a negotiated sale may open the door for serious abuses, one is inclined to wonder if the fear of criticism does not cause local officials to shy away from this form of sale in certain instances where it could be used to advantage.

Maturity Schedules

The general pattern for the maturity schedules is determined at the time the long run financial plan is adopted, although as already noted a sound plan leaves considerable flexibility for adjustments to current conditions in the market. When bank reserves are high and short term rates are low, for example, it may be wise to increase the maturities at the short end. However, the practice followed by a few issuers—using very short maturities depending upon refunding to meet maturities—carries a great deal of risk. At the other extreme, when the annual debt service seems high it is likely to prove very expensive to attempt to reduce it by extending maturities. This will not only result in interest being paid over a longer period, but the rate is usually higher at the long end. In preparing the maturity schedule for an offering the financial official in charge should consider the need for future financing, and what the maturity schedule will be in ten years.

Call Features

The decision on the type of call features, if any, to include in a bond indenture should be made in the light of conditions as they exist in the municipal market at the time the offering is ready for sale. It should be remembered that a call provision is an option—which may be costly. The inclusion of a call feature which investors dislike may result in considerable sale resistance, and hence a lower bid. But against this the issuer must weigh the risk of being caught in a period of low interest rates with high coupon bonds which cannot be refunded. Various methods have been used to limit the option, thereby reducing investor resistance (and cost). The bonds may be made callable at premium; the optional date may be postponed; or the bonds may be callable only for certain purposes. It is sometimes feasible to break an offering into two parts, one of which is made callable.

There is growing recognition of the fact that rigid rules or preconceived ideas regarding call features are likely to be expensive for the issuer, and the trend is toward a careful study of this provision in each case. The practical approach is to survey the market, making an estimate of the probable effect on the bid of a particular call feature, and then determining whether the probability of needing this option warrants the cost. A sound financial

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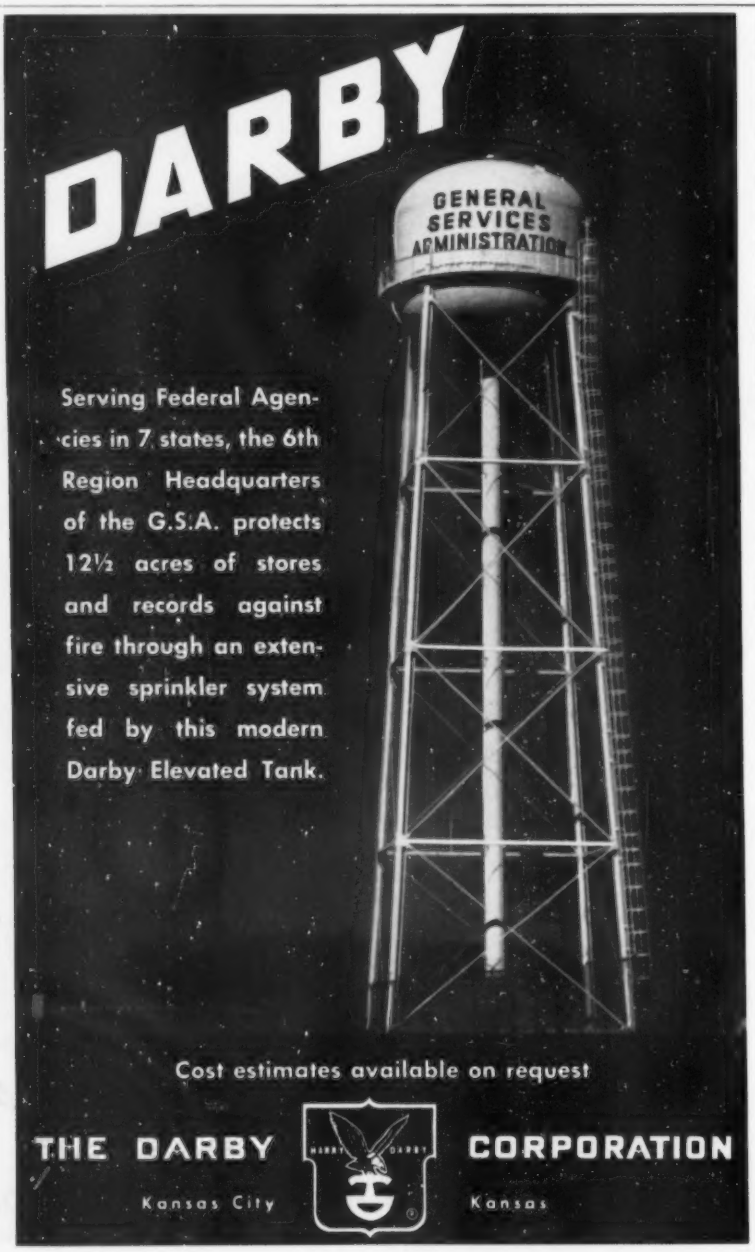
plan will provide a basis for judging the type of call feature which is most likely to be worth while at a later date to the issuer.

Security

The basic decision on whether to use general obligation bonds or revenue bonds is usually made at the time the financial plan is adopted. Even when general obligations are used, specific revenues may be pledged. Generally speaking, a jurisdiction with a good credit record will not find it advantageous to make such a pledge. Some investors, however, are impressed by what they term "double barrel" security, and there are times when a special pledge will result in a lower interest rate, which the issuer may be tempted to accept. Before making such a commitment, however, the responsible officials should consider carefully, whether the proposed pledge will result in a rigidity which may become embarrassing at a later date. Pledges of specific revenue, if not carefully hedged, may interfere with a sound financial program at a later date.

In the case of revenue bonds the various protective covenants are extremely important. The pledge of revenues should be such that the investors are protected against diversion of revenues and as far as possible against mismanagement. The latter is, of course, extremely difficult, since tight restrictions often prove to be self defeating. Enough flexibility must be left with the management so that the properties can be managed efficiently. Provision must be made, for example, for the restoration of assets involved in an accident. A covenant is usually included providing that rates will be established and maintained at levels which will provide adequate funds for debt service. The establishment of a series of reserves will often make a revenue bond issue more acceptable to investors, but this may increase the amount of funds which must be raised. The indenture should also provide for the disposition of revenues in excess of those needed for debt service. In some cases in the past this has been sufficient to provide security for future issues.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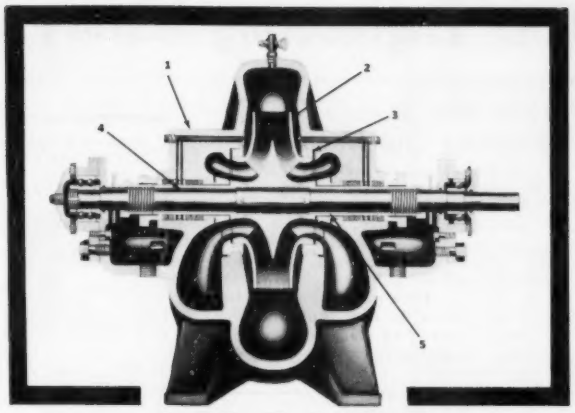
Important Technicalities

Careful attention to the many technical details of setting up an offering will assist materially in obtaining a better bid. Proper advertising for example, is necessary so that all prospective bidders will hear about the offering. Furthermore, provision should be made for answering all inquiries promptly. Consideration should be shown for the investor by making it as easy as possible for him to obtain payment of interest and principal when it becomes due. It may be advantageous to allow the successful bidder to name the paying agent and the other agency positions.

Generally speaking, the coupon should be as near the yield at which the bonds are to be sold, as possible, since the bookkeeping is easier for investors if there is neither a premium nor a discount to amortize. Also in the case of bonds sold at a discount, holders are likely to lose some of the benefits of tax exemption. There are, however, some important exceptions. Certain buyers have preferred high coupon bonds (high premium) in the short maturities. At the other end of the scale, a few issues have been sold successfully with very low coupons (large discounts) at the long end. These are special situations. The provisions sometimes found in the enabling legislation requiring that the issuers receive at least par are unwise. Since the distributors must receive compensation, such a provision has the effect of requiring that the bonds be sold to investors at a



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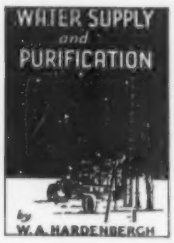

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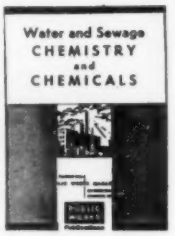

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This major article was prepared in close collaboration with U.S. Public Health service authorities. It includes, for the first time in magazine history, full and accurate color plates for the identification of types of algae most important in water supplies—those which cause taste and odors, clog filters or are likely to be found in clean or polluted waters. Color plates of this quality have never before been available to simplify the job of algae identification. To order your copy circle A-5 on the coupon.

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An authoritative yet simple treatment of the subject by one of the nation's foremost authorities. Mr. Hardenbergh's editorial and field work has brought him in close contact with the problems that trouble the average engineer and in this book he explains those methods most suitable for general use. Special attention is paid to sewerage systems, both storm and sanitary. Design examples of all kinds are worked out in detail to illustrate practical, up-to-date methods. To order your copy circle A-6 on the coupon.

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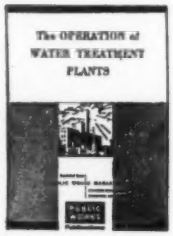
The Operation of Water Treatment Plants



Here in one place you have the basic information concerning all phases of plant operation. Even those without previous technical school education will find it easy to learn from this valuable text. Completely revised, expanded and brought up to date by Clayton H. Billings, Associate Editor of Public Works. This reprint is of special interest to Water Works Superintendents, Water Treatment Plant Operators and everyone connected with the Water Works field. To order your copy circle A-8 on the coupon.

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premium. At times, this will result in a poorer bid than would otherwise be the case.

Conclusion: This is the last in a series of four articles dealing with the problems of state and local governments in financing the large volume of capital improvements required by our expanding population. The first article in the August, 1958, issue of PUBLIC WORKS described the market in which the new offerings are sold. The second article in February, 1959, discussed the need for financial planning and the need for co-ordination with physical planning throughout the entire planning process. The third article, April, 1959, centered around the problems of formulating a financial plan. This article continues with the administrative problems of financial planning particularly those centering around the preparation of new offerings for the market. It seems appropriate to conclude these articles with a few general observations.

Financial planning is an art not a science. It must be based upon forecasting which necessarily contains a considerable element of uncertainty. The efforts of local governments, however, to plan ahead in the realm of finance, promises to be very productive, in the sense that it will avoid substantial losses. A rational attempt to prepare for the inevitable adjustments required by the transformation taking place in so many urban areas will highlight the inadequacies of current policies while there is yet opportunity for constructive action. It often happens that the period of time during which sound policies can be economically inaugurated is very short. In almost all cases postponement will result in added costs.

The aim of financial planning, which is a part of good fiscal administration, is not so much a few spectacular savings, although this is a possibility, but rather a series of innumerable and continuing small economies which accumulate to sizeable amounts. The wastes of the financial sprawl which inevitably results from muddling through are so great that one is inclined to become alarmed as evidences of inadequate planning are seen in many areas. The strength of the economy of the nation and of most metropolitan areas, however, is so great, that it is not a crisis that most jurisdictions face, but rather a series of painful jolts. Careful planning through its contribution to efficient management will result in lower taxes than would otherwise be necessary for the same level of services.

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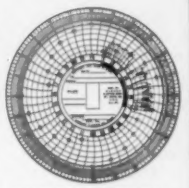

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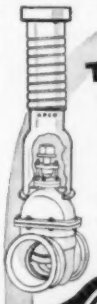

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H. A. RADZIKOWSKI, Chief,
Division of Development,
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IF IT HAD not been for the ability of equipment manufacturers and contractors to increase machine productivity at a rate which continued to offset to a considerable extent the rise in other cost elements, the expanded highway program would not be economically feasible. For example, it costs no more to move a yard of dirt today than it did over 30 years ago, although other factors which contribute to earthmoving costs, including labor and materials, have increased about 300 percent during the same period. Improvements in equipment design have provided greater speed, capacity and adaptability as well as reduction of operator fatigue and overall simplification of operator training. Equipment developments have been so rapid that highway design engineers can provide for maximum quality work and economy of operations only if they keep abreast of equipment potentialities.

Right-of-Way Clearing

A new clearing blade, mountable on a large crawler tractor, can shear off tree trunks at stump height or flush with the ground. If the trunk is too large to cut off in one piece, it can be split into shearable size with a sharpened prong called a stinger. Both the shearing edge and the stinger are knife sharp. The land clearing device can also be used for stump removal, stacking, ditching and topsoil removal.

About a year ago a Virginia contractor developed a stump axe which is helping to revolutionize land clearing operations, especially where it is deesirable to convert merchantable timber into logs. The large pivoted cutting knife is mounted on a special power shovel front and has the action of a backhoe. The axe shaves away the stump in 4 to 6-inch slivers which can be dried and burned in a short time. This equipment is reported to be capable of removing 3-ft. diameter stumps in from two to three minutes and 6-ft. diameter stumps in less than ten minutes.

Earthmoving Equipment

One of the most significant developments in the earthmoving field during the last several years has been the rear-mounted tractor rippers. With total tooth pressures of four or five times that of old pull models, these rippers are capable of breaking up rock and shale strata which required drilling and blasting only a few years ago. These hydraulically controlled rippers are also capable of penetrating relatively deep frost layers and thereby keeping excavation work going for a much longer period. One of the problems now involved in bidding many earthmoving jobs is the determination of how much of the subsurface rock can be processed with heavy duty rippers and how much must be drilled and blasted. Several devices are now capable of making this determination from readings taken on the surface. One is the earth-resistivity equipment developed by the Bureau of Public Roads and another is a highly portable seismic device which measures the speed of impulses set up by the blow of an 8-lb. hammer on a steel plate placed on the surface.

Speed and capacity are prime requisites for hauling equipment: A modern hauling scraper can be loaded at rates of nearly a cubic yard per second, operated at hauling speeds up to 25 mph and steered effectively on tight turns with full hydraulic steering. Pay loads of 30 cu. yd. are now commonplace, and one manufacturer is producing a scraper combination which is capable of hauling payloads up to 48 cu. yd. (38 cu. yd. struck rating). Perhaps the latest in scraper operation is the introduction of gears for raising and lowering the cutting edge and apron and for pushing the tailgate to unload. This power control feature gives positive action to lowering of the front apron in place of a gravity drop.

Present indications are that we may not have reached the ceiling for the practical capacity of scraper combinations. A twin tandem scraper of 100 cu. yd. capacity which is powered by electric wheels is being field tested in the construction of the International Airport at Chantilly, Virginia. Also on the site under observation is one of the largest wheel type tractor-dozers of 600 brake hp and 92,000 lb. weight.

Continuous advancements in design have been made in the power shovel and crane field, including greater capacity, ease of controls, greater operator comfort and increased use of torque converter drives and automatic transmissions. One manufacturer has recently introduced power controlled outriggers for motor cranes which are operated from the cab. It takes only little more than a minute to set up under varying ground conditions and less than two-thirds of a minute to pull up and reset exclusive of travel time.

Air compressors have also undergone major developmental changes in the last five years. The vane-type rotors for compressing air provide for only a fraction of the moving parts required for the reciprocating types and are, therefore, more economical to operate and repair.

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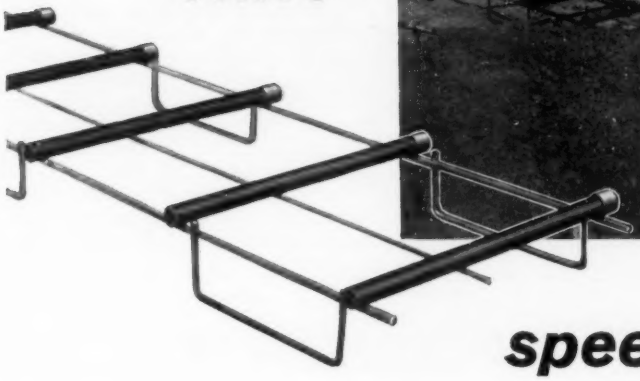

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position or to a desired crown slope without interference from the irregularities which are encountered by the grader wheels. With the operator's attention no longer required for maintaining the vertical angle of the blade, he is able to concentrate most of his efforts on following blue tops or a string or wire reference parallel to the finished grade. It seems quite likely that in the near future we will have automatic profile control as well as automatic cross-section control for both base and pavement construction, thus further reducing the opportunity for human error.

Also developed recently is a fine-grade planer which shows promise for obtaining smoother profiles for base and subgrade construction. The principal feature of this new machine is its long wheel base which measures some 44 ft. 8 ins. in length. This appears to be a step in the right direction, since it is being realized in some quarters that straight edges of lengths varying from 10 to 16 feet are not sufficient for good profile control. (The California Division of Highways is using a profilograph with 25-foot wheel base for measuring pavement smoothness.) Other features of this fine-grading machine include full hydraulic controls and combined blade and cross slope accuracy of 1/25-inch in 15 feet.

Bituminous Paving Equipment

With the use of electric and hydraulic controls and timing devices in the mixing and processing of bituminous materials, one man can start the process and watch the plant go through the various cycles of automatic batching, dry mixing, weighing and introduction of asphalt, wet mixing and discharge the mix to trucks. Should the quantity of any size of aggregate in the storage bin be inadequate for the requirements of a batch, the mixing operation automatically stops. With these automatic controls it is possible to proportion accurately all sizes of aggregate simultaneously, also to have some cycles overlap, such as weighing the second batch while the first batch is being mixed and discharged from the pugmill. The automatic timing assures the proper sequence and prevents the starting of one operation until the previous operation has been completed.

One new crawler model paver is equipped with an electric vibrating screed which operates at 3,600 vpm. It is claimed that this feature permits higher operating speeds because of the reduced tendency to create voids or "pull" the mat. The transmission has 15 paving speeds varying from 11 to 102 fpm and a maximum travel speed of 2.2 mph. This unit is reported to have operated successfully at speeds up to 58 fpm on binder courses.

Several years ago a pneumatic-tired paver was placed on the market and the original model has undergone several improvements since that time. Some of the advantages claimed over the crawler type are lower maintenance and repair costs due to the elimination of hundreds of moving parts, longer wheel base and higher travel speeds. This original model is capable of paving widths from 8 to 13 feet at speeds up to 60 fpm. A similar model is now in the development stage which employs greater automation, including automatic load equalizing, and is capable of laydown speeds up to 100 fpm. Another manufacturer has recently introduced rubber tires on its paver finisher for faster travel speed and has increased its crawler paving speed from 64 to 101 fpm.

An Italian inventor has perfected an electronic grade control device for an American bituminous

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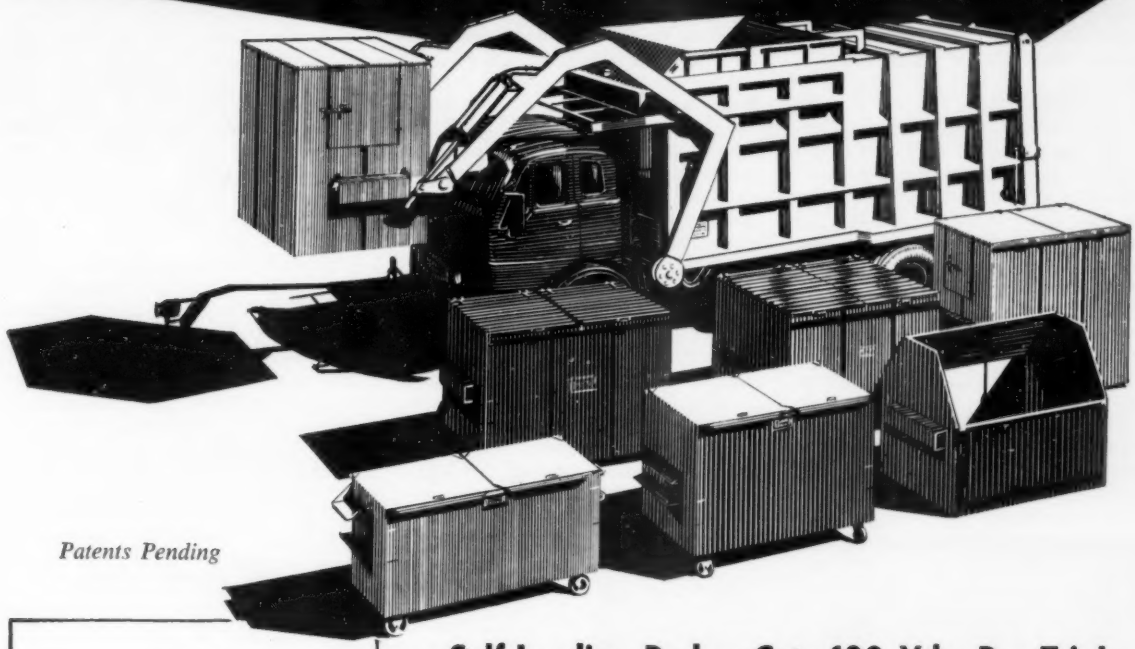

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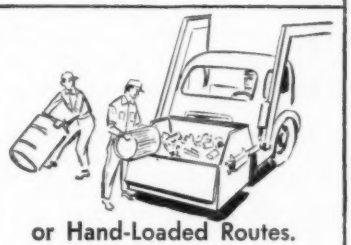

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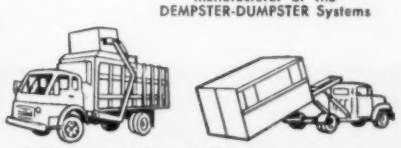

Dept. PW-6 DEMPSTER BROTHERS Knoxville 17, Tennessee

finisher. A sighting device on the finisher follows a guide line parallel to an established longitudinal grade line. A profile tolerance control of about 1/8-inch in 330 ft. is claimed for finishers equipped with this device.

A recently developed high capacity self-propelled chip spreader operates at speeds of up to 15 mph. The spreader unit is designed to produce a tighter, more uniform surface resulting from placing the larger chips first and filling the voids with the finer stones. When rolled, there is an improved imbedment over that obtained with unsegregated stone chips.

A pavement equipment manufacturer has just announced the availability of a pavement widener which is adjustable in widths up to 10 feet. This machine is not only capable of placing bituminous base and surface courses, but may also be used as a spreader for portland cement concrete and aggregates. It should be of considerable value in city paving work where substandard lane widths are often encountered.

There seems to be a trend toward greater use of plant mixed dense graded type base courses where bitumen, cement or calcium chloride is used as the stabilizing agent. Plant mixing assures better uniformity of mix through controls that are not possible in mixed-in-place operations. A number of stabilizing plants with capacities of from 400 to 600 tph are now on the market. The plants are essentially an elevated pugmill with receiving and discharge hoppers and provisions for adding water or bitumen.

Aggregate Production Equipment

The importance of improved aggregate production equipment cannot be overemphasized, since almost 20 percent of the on-site cost of highway construction is attributed to aggregate requirements. The ability to process local deposits of aggregates at their source decreases hauling costs to the job. Sources of inferior aggregates which were previously rejected can now be used in many instances, thus greatly increasing the availability of such natural resources for the highway program.

Today a modern portable plant produces up to 500 tph of better graded material. This increased capacity is due principally to the new twin jaw crusher which also utilizes higher crushing speeds. Another dual unit crusher, the double impeller impact breaker, is also a recent development for producing big volumes of specification material. This unit produces reduction ratios as great as 50 to 1 while providing cubically shaped particles even in slabby material. The unit also has upgrading features by disintegrating softer materials to fines which can be screened out.

Other improvements in aggregate producing equipment include a vibrating feeder which eliminates fines before entering the crusher chamber, electrified portable and stationary plants, screens with greater efficiency combined with larger capacities, use of more durable fabrication materials to reduce maintenance costs and easier and faster adjustments by which closer tolerances and more rigid quality control are possible.

Editor's Note:

The preceding material is the first portion of a paper presented at the 1959 Ohio Engineering Conference in Columbus, Ohio. It has been slightly condensed from the original. The concluding part of the paper, which covers equipment for compaction, concrete paving and construction of bridges and other highway structures will be presented in the July issue of PUBLIC WORKS.

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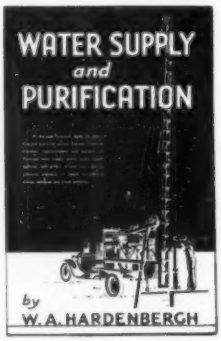

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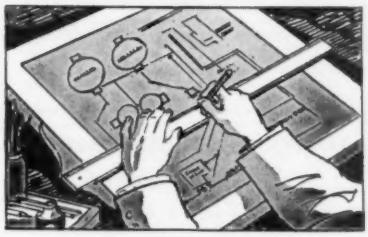

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(*Continued from page* 107)

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The scope of the utility work undertaken can be better grasped from the fact that over 3¼ miles of trenching were done in the half-mile stretch of street. Assuming an average 3-foot trench width, this comes to 1/3 of the total street area.

In planning the job, the highway department had agreed with the City of Wilmington to maintain two lanes of traffic on the street during construction. This proved impractical, however, because the water main serving the abutting properties was located at the north edge, and renewing services to the properties on the south side required cross-ditching the full width of the street.

To maintain traffic on as much of the street as possible, and at the same time to bring some order into the utility work so as not to delay the contractor, the Utilities Division prepared an addendum to the bid proposal that was immediately sent to all prospective bidders. It set forth in some detail the procedures and schedule to be followed by the contractor and the utilities.

Scheduling the Work

The addendum prescribed that the project be done in three successive sections—Section A, 2 blocks; Section B, 3 blocks; and Section C, 4 blocks. Six stages of work were defined within each section, and the traffic maintenance requirements given. The stages were:

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waste base, and installing traffic signal conduit.

e) Setting of forms, fine grading and paving.

f) Curbs, sidewalks and other construction in back of curbs.

In each section, the street was to be closed to traffic from the second half of stage "a" through the first half of stage "e", and stage "a" of the next section was to begin as soon as two lanes of new pavement were available for traffic in the previous section. All intersections were to be kept open throughout the construction period.

After work began on Section A, the traffic engineer of the City of Wilmington decided that the decreased traffic on the street did not warrant keeping all of Section B open, or justify the added construction time required if traffic were to be maintained through intersections. Accordingly, all of Section A and half of Section B, including all intersections, were closed until paving was completed, after which stage "a" was begun on the second half of Section B and all of Section C. In effect, the job was done in two sections rather than three as originally planned. While this accelerated somewhat the work of both utilities and contractor by eliminating delays due to traffic, it had little effect on the sequence of operations, which was the most important factor in coordinating the work of the utilities.

From the contractor's standpoint, the most helpful part of the addendum was the estimate of utility working time required for stage "b" in each section. With this figure available, he was in a position to schedule stages "c" and "d"—drainage and grading—with a reasonable degree of assurance that he could move in and go to work at that time.

The utility estimates were arrived at with representatives of the utilities after careful consideration of the specific work to be done in each block of each section, even to the location of the facilities in the street (to determine if crews from several agencies could work at the same time).

The schedule called for all utility work to be finished in 85 working days—about four months. As can be seen from Fig. 1, the first utility was to begin its work on Section C when the last was finishing on Section A. At some times, several agencies were scheduled to work together. The seeming confusion at one downtown intersection when crews from four different utilities were working at the same point was only

an impression given to bystanders; they had been scheduled to work there, and no conflict resulted thanks to the careful coordination of their work by representatives of their companies and agencies on the utilities committee.

Bids on the contract were opened March 19, and the job was awarded to Olivere Paving and Construction Company, Wilmington, at a price of $368,650.34. From a construction standpoint, it entailed reconstructing 0.498 mile of a 51 to 57-foot street to a uniform width of 60 feet, using an 8-inch concrete base course with a 2¾-inch sheet asphalt surface. An additional 1.298 miles of existing 57-foot pavement was to be resurfaced with 2¾ inches of sheet asphalt. Required completion date was June 1, 1959, with the concrete base course to be finished by November 1, 1958.

Results of Coordination

On April 10, the contractor attended a pre-construction meeting with the Utilities Coordinating Committee, where he learned each utility's plans and, more important, the person he could talk to if problems should arise. On April 14, Olivere began construction on stage "a" of Section A, and two days later a crew of the Wilmington Water Department began work on stage "b".

Work continued throughout the summer with no complications or confusion in spite of the unusual amount of utility relocation. Regular meetings of the coordinating committee were held at weekly intervals to review progress and take care of minor changes in plans or detailed schedules as necessary.

By September, all stage "e" work was completed—months ahead of schedule—and at no time had the contractor experienced any delay in connection with utilities. In fact, all utility work (stage "b") was completed one day ahead of the estimated elapsed time schedule of 85 working days. The 4th Street project, which could well have been a series of frustrating and expensive construction delays due to utilities, proved conclusively the value of coordination centered in a staff professionally qualified in both highway and utility practice.

From a less professional viewpoint, Utilities Division personnel are also deriving considerable satisfaction from the observation made by a utility official to the Chief Engineer of the State Highway Department: "We never knew before that we utility people could get along with each other so well."

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EQUIPMENT NEWS

Pick-up has a standard 141-hp engine

New Line of International Trucks

Advancements in styling, power and pickup body design have been combined with a high degree of truck-to-job model specification in a new line of International trucks now introduced in the 4,200 to 33,000-lb. GVW range. Designated the B-line, these new light, medium and heavy-duty trucks are available in four and six-wheel and all-wheel-drive chassis, with six-cylinder or V-8 engines and a wide choice of conventional and compact-design models. Optional on light and selected medium-duty models are automatic transmissions, power steering, power brakes and four-wheel drive. Four and six-wheel-drive and tandem-axle drive systems are available on selected medium and heavy-duty chassis. Nine International six - cylinder valve-in-head truck engines provide a lineup of high-torque standard powerplants. These six-cylinder engines are offered with horsepower ratings from 113 to 154. Five are gasoline fueled and four are available with factory-installed liquefied - petroleum - gas fuel systems. Three new V-8 engines, with 266,304 and 345 cu. in. displacements are optional equipment throughout the International B-line. Available in 7 and 8½-ft. lengths, pickup bodies provide capacities of 59.25 and 72.75 cu. ft., respectively. Inside width between top flanges is 66 ins., width at tailgate opening is 50 ins. and height is 17¾ ins. Complete details from Consumer Relations Dept., International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill., or circle **No. 6-1** on the reply card.

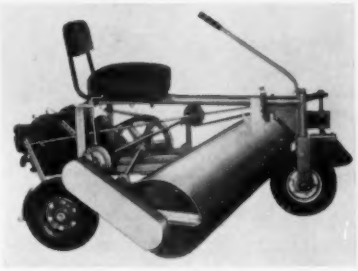
Portable Spray Machine

A new portable spraying machine, designed to spray concrete curing membrane on freshly poured concrete, has been developed by Champion Mfg. The unit is ideally suited for use on short runs of pavement, on highway cloverleafs and for side edge spraying after forms are removed. Another application is the oiling of forms before use. The unit comes equipped with the necessary attachments for various kinds of spraying and has a 15-gallon tank. Two large pneumatic tires make the unit easy to push over any surface and a rear swivel wheel provides easy maneuverability. Champion Mfg. Co., 3700 Forest Park Ave., St. Louis, Mo., or circle **No. 6-2** on the reply card.

Automatic Pumping Controls

Synchro-Start has designed a new automatic control especially for use on pipeline pumping. This is a program timer control for use on gas, gasoline or diesel engines and it is encased in a steel, weatherproof enclosure. The control includes one of their standard automatic engine controls together with a timer driven by a governed DC motor. All current is taken from the engine battery so that no commercial power is required for operation. Many variations are available, including safety protection for all abnormal conditions. Complete details from Synchro-Start Products, Inc., 8151 N. Ridgeway Ave., Skokie, Ill., or circle **No. 6-3** on the reply card.

Controls are used to preset engine for the length of time of operation



Broom meets specifications of most city, county and state highway depts.

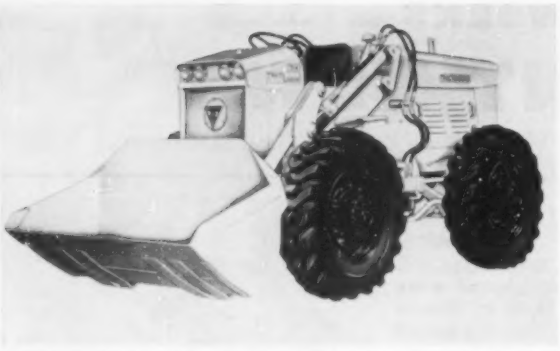
Power Broom

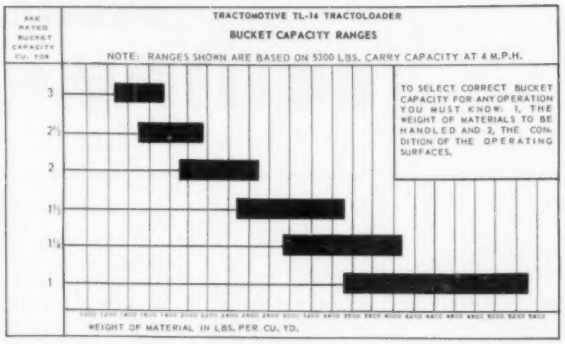
The Ken Roll power broom is made specifically to comply with city, county and state highway requirements. This broom features all steel, welded construction and closed differential, left foot operated clutch and right foot operated brake, glass sealed ball bearings plus a wide variety of broom segments for different sweeping jobs. The broom segments are easily replaced. A spring cushion seat allows for maximum operator comfort and broom height is regulated by special adjustment next to driving seat for maximum economy of operation when moving from job to job. Details from Pfahler Mfg. Co., Galion, O., or circle **No. 6-4** on the reply card.

Gar Wood Pipeline Ditcher

A new medium-duty pipeline ditcher, featuring a torque converter drive and complete hydraulic action, has been introduced by Gar Wood. Known as the Model 318, the ditcher digs to 7 ft. in depth, with widths of cut to 44 ins. It is transportable on standard trailers, without any special teardown. A torque converter throttle lets the operator change his output by 40 percent within any gear range without loss of horsepower. Fingertip controls let the operator control the placement of spoil by varying the speed of the spoil conveyor and spoil can be discharged from either side of the ditcher. Complete details from Gar Wood Industries, Inc., Wayne, Mich., or circle **No. 6-5** on the reply card.

TractoLoader Front End Loader Has a 5300-lb. Carry Capacity




TRACTOMOTIVE TL-14 TRACTOLOADER
BUCKET CAPACITY RANGES
NOTE: RANGES SHOWN ARE BASED ON 5300 LBS. CARRY CAPACITY AT 4 M.P.H.
SAE RATED BUCKET CAPACITY CU. YDS.
3
2½
2
1½
1¼
1
TO SELECT CORRECT BUCKET CAPACITY FOR ANY OPERATION YOU MUST KNOW: 1. THE WEIGHT OF MATERIALS TO BE HANDLED AND 2. THE CONDITION OF THE OPERATING SURFACES.
WEIGHT OF MATERIAL IN LBS. PER CU. YD.

As shown in the table, the choice of bucket depends upon the weight of material to be carried in pounds per cubic yard

The new TL-14 TractoLoader announced by Tractomotive incorporates special features designed for speeding excavating-loading work and easy operation. The 14,480 lb. unit has a carry capacity of 5300 lbs., maximum lifting capacity of 11,000 lbs. and a breakout force of up to 17,800 lbs. Six buckets are available for use with the TL-14, ranging in size from one to three cu. yds. The buckets tip back 42° at ground level for fast loading. For maximum stability while traveling, the bucket can be tipped back at an angle of 47° when only 14 inches above the ground. Maximum dumping clearance under the hinge pin is 10 ft. 5 ins. The unit is powered by either an 86-hp, 6-cylinder Allis Chalmers gasoline engine or an 81.5-hp A-C Diesel engine. More details from Tractomotive Corp., Deerfield, Ill., or circle **No. 6-8.**

Bucyrus-Erie Unit for Drilling Wells to 1,000 Feet

Continuing its expansion into the rotary water well drill field, Bucyrus-Erie has introduced the heavy duty Model 30-R for drilling medium diameter water wells to a depth of 1,000 feet. The new drill is available on two truck mountings —one with independent engine drive, Model 30-RS, and the other with power takeoff from the truck engine, Model 30-RP. Down-the-hole tools are available for both units. The 30-R also is available as a blast hole drill on both truck mountings or on crawlers. The 30-R will drill 6¼ to 7⅞-in. diameter blast holes. The water well drill pipe rack of the 30-RS and 30-RP holds five lengths of 21 ft. 3-in. pipe. The rack is easily swung into alinement over the hole. Cuttings are removed either by air or mud bailing. Air for rotary drilling is supplied by a single-stage 667-cfm compressor. For additional information write the Drill Division, Bucyrus-Erie Co., Richmond, Ind., or circle **No. 6-6** on the reply card.

Bucyrus-Erie Model 30-RP drilling rig

Reflectorized Plastic Pavement Marking

Permanent-type reflectorized plastic pavement marking is announced by Prismo. The product, Plastix SD, is coated at the factory with a newly-developed adhesive backing that makes application simply a matter of placing it on the pavement, and applying light pressure. It grips instantly and quickly and develops balanced tensile strength. The reflectorized plastic incorporates a completely new process that has high chipping resistance, excellent plastic cold-flow characteristics, and ability to reseal itself to pavement contour in event of pavement fault. It is skid-proof in both wet and dry weather, and as a result presents no pedestrian hazard. The face is immediately reflective, and reflectivity increases with wear of traffic, since the reflective glass spheres are mixed into the plastic before it is formed into reels, strips, blocks or legends. More information from Prismo Safety Corp., Huntingdon, Pa. or circle **No. 6-7** on the reply card.

Barber-Greene Model 774 Wheel Ditcher

Barber-Greene has just announced that their Model 774 wheel ditcher can now be equipped with a wheel to dig to a maximum of 30 ins. wide and 7 ft. deep. This deeper digging depth brings ditching economies to such fields as municipal water and sewer construction and drainage. Through a unique spoil conveyor design, the unit loads directly into trucks, thus eliminating re-handling of the spoil after excavation. The wheel is supported by an extra roller assembly, giving a four-point support. Wheel construction is also unique in that the rims are cut from one solid plate of manganese steel. Complete details from Barber-Greene, 400 No. Highland Ave., Aurora, Ill., or circle **No. 6-9** on the reply card.

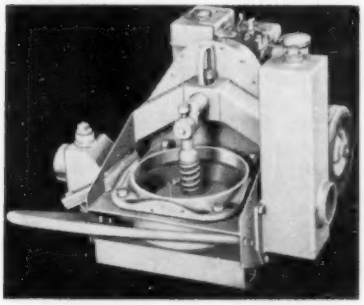
Ditcher is equipped with a seven-ft. wheel and loads directly on the trucks

New Intake Screen

A new intake screen for river and lake reservoirs has been developed by Edward E. Johnson. The Johnson intake screen can be used in many river and lake reservoirs in place of a crib. The design of the screen also permits efficient backwashing. It can also be used in infiltration galleries or collectors, in dam intakes, in river bank intakes and for many other difficult intake problems. For complete information write Edward E. Johnson, Inc., 315 North Pierce St., St. Paul 4, Minn., or circle **No. 6-10** on the reply card.

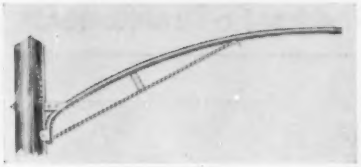
Barnes Diaphragm Pump Line

A completely redesigned and expanded line of diaphragm pumps in the 1½ to 4-in. size range has been announced by Barnes. Rubber-faced swing-type flap valves and replaceable discharge valve seats are easy to replace and provide free passage of solid foreign materials. Threaded suction connections are also easily and inexpensively replaceable. The diaphragm itself can be replaced with a standard open



Diaphragm pump comes in several sizes

end wrench without tilting the pump or disturbing the hose. Standard models in the line are available in 1½, 2, 3 and 4-in. models. The 1½-in. model has a 2-in. discharge, is powered by a 2-hp Briggs gasoline engine, weighs 145 lbs. on wheels and delivers 3,000 gph at a 5-ft. lift. The 2-in. model has 2-in. discharge, is powered by a 2.5-hp engine, weighs 160 lbs. on wheels and delivers 3,500 gph at 5 ft. The 3-in. has a 3-in. discharge, powered by a 2.5 hp engine, delivers 5,500 gph at 5 ft. The 4-in. has a dual-threaded suction connection permitting either 3 or 4-in. suction, has 4-in. discharge, powered by a 4.5 hp Wisconsin engine, weighs 460 lbs. on wheels and delivers 6,000 gph at 5 ft. Detailed specifications from Barnes Mfg. Co., Mansfield, O., or circle **No. 6-11** on the reply card.



Street Light Bracket Redesigned

Hubbard and Company's most popular street light bracket, the round brace type No. 23208, has been improved by the addition of a flat steel supporting strut between the pipe and round brace. The greater strength thus provided the bracket makes it ideally suited for use with 400-watt mercury vapor luminaires with built-in ballasts. The 8-ft. long bracket of galvanized steel is designed for attachment to wood poles, or metal poles by using bands. For further information write Hubbard and Co., 200 So. Michigan Ave., Chicago 4, Ill., or circle **No. 6-12** on the reply card.

Maximum Density Roller

A new model pneumatic tired roller having ground pressures exceeding truck load limits is announced by Tampo. Specially designed for maximum density rolling of asphaltic mats and all finish surfaces, this new Model SP-900 features 85 psi of compaction effort to meet latest specification requirements. These higher unit pressures densify surfaces beyond traffic stress, resulting in a stable roadway. Complete data from Tampo Mfg. Co., Inc., P. O. Box 4248, Station A, San Antonio 7, Tex., or circle **No. 6-13** on the reply card.

Telescoping Boom and Aerial Platform

A new and improved hydraulically-operated telescoping boom and aerial platform has been developed by the IM Division of the Peters Co. The Industrial Monkey, Standard Model "V", reaches 40 ft. 9 ins., giving an average working height of 48 ft. Designed to be mounted on 16,000-lb. or heavier truck chassis, the unit completely eliminates the need of outriggers. All movements are actuated by double-acting hydraulic cylinders, and the work platform is automatically kept level by a double-acting cylinder at its base. The work platform is fully insulated, having a dielectric deck mounted on insulators for operator safety. Complete data from Peters Co., 1933 S. E. Union Ave., Portland 14, Ore., or circle **No. 6-14** on the reply card.

Weight Cut on Portable Low-Pressure Meters

A new line of lightweight, portable low-pressure meters has been introduced by Sparling for use in open ditches, in field culverts, on well discharges or where temporary metering is desired. Constructed of aluminum alloy, the entire meter weighs as little as 16 lbs. and may be transported easily by one man. The new line of meters consists of five units ranging from 4 to 12 ins. in diameter, and from 16 to 40 lbs. in weight. Flows are registered as low as 60 gpm and as high as 2,000. Total flow is shown on a six-digit straight reading totalizer which registers in units for multiples of acre-feet, cu. ft., gallons or other standard units. Further information from the Sparling Meter Co., Inc., 225 No. Temple City Blvd., El Monte, Calif., or circle **No. 6-15** on the reply card.

Hough Announces New Model H-120 Loader With 300 HP Engine

Frank G. Hough, has announced the addition of a new Model H-120 to its line of rubber-tired, four-wheel-drive "Payloader" tractor-shovels. With the bucket dumped at 50°, clearance under the bucket edge is 10 ft. 10 ins. and the forward reach from the front tire is 3 ft. 6 ins. It is powered by a turbo-charged Cummins diesel engine which develops 300 hp at 2,100 rpm. The recommended load "carry capacity" is 12,000 lbs. Buckets from 3 to 6 cu. yds. are offered for handling various materials where the total load weight falls within the "carry capacity" range. The unit features a four-speed, forward and reverse, power-shift transmission and matched torque-converter which provides travel speeds up to 28 mph. The operator's compartment is protected by a canopy cab as standard equipment. For complete details write to The Frank G. Hough Co., 761 Seventh St., Libertyville, Ill., or circle **No. 6-16** on the reply card.

Bucket sizes are from 3 to 6 cu. yds.

Galion Self-Propelled Pneumatic-Tire Roller

Complete visibility is provided for working close to curbs, bridges and buildings

Just announced by Galion is a new 9-wheel, 12 ton, self-propelled, rubber-tire roller for base and finish surface compaction. It has four drive-compacting wheels and five steering-compacting wheels. The front and rear wheel treads overlap. The overall design of this new roller is said to provide complete visibility for operating close to curbs, buildings, etc. Each tire, wheel and wheel brake is serviceable individually; the completely enclosed drive chains are easily accessible and serviceable individually; and the entire power train can be removed as a unit. The exclusive front axle feature, together with individual steering of the five front wheel units, is claimed to provide maximum support to the roller on uneven ground. Hydraulic steering requires little operating effort. The roller weighs 8,000 lbs. and when fully ballasted, it is claimed to weigh 24,500 lbs., with a maximum load of 2,722 lbs. per tire or 340 lbs. compression per inch width of tire. The gasoline engine is rated at 80 hp. A four-speed synchromesh transmission provides four speeds forward and four reverse, ranging from 0.75 to 16 mph. For complete information write The Galion Iron Works & Mfg. Co., Galion, Ohio, or circle **No. 6-17** on the reply card.

Shawnee 88 Backhoe

The new Shawnee 88 backhoe features a unique 188° swing action which provides lifetime compensation for wear. This swing action is accomplished through two single acting hydraulic cylinders mounted in a vertical position on the main frame of the backhoe. Attached to these cylinders is a heavy duty roller chain which operates a specially designed sprocket that is attached to the base of the pivot assembly. Because the cylinders are designed so that they never bottom entirely, the chain is tight at all times. The swing cylinders are controlled with a cushion valve which provides better control of the swinging operation and enables the operator to obtain greater speed. The digging depth is 12 ft. Dumping height is 9 ft. 9 ins., reach is 17 ft. For additional information write Shawnee Mfg. Co., Inc., 1947 North Topeka Ave., Topeka, Kans., or circle **No. 6-18** on the reply card.

Shawnee backhoe can swing 188 degrees

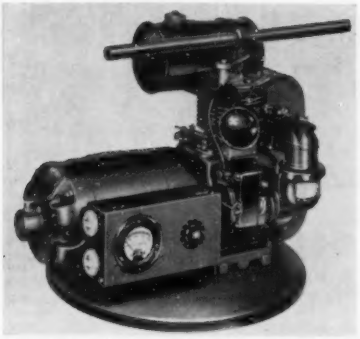
Maps from Aerial Photographs

A new instrument called a Stereomat, which automates the production of maps from aerial photographs, is being made by Benson-Lehner. The unit will perform automatic profiling and semi-automatic contouring. This instrument has great possibilities in many fields which require fast, accurate mapping service. It will also greatly simplify highway profiling, cross-sectioning, stereo - triangulation, preparation of terrain models and computation of earthwork quantities. The Stereomat is basically an automatic scanning correlator which can be mounted on conventional, projection-type plotters in place of manually - operated stereo - mechanisms. A cathode-ray tube replaces the usual platen. Vertical movement of the tube and leveling adjustments for the projectors are controlled by servo motors. The instrument traces correct contour lines by means of a complex array of electronic, optical and mechanical apparatus. Complete details from Benson-Lehner Corp., 11930 West Olympic Blvd., Los Angeles 64, Calif., or circle **No. 6-19** on the reply card.

Lorain Front End Loader

A new 2-yd., 4-wheel drive front end loader, called a Lorain Moto-Loader, has been announced as an addition to the Lorain line replacing Moto-Loader Model ML-156. Features are: One-foot control of travel direction and speed for fast, smooth cycles that leaves hands free for other operations; excellent work visibility even when all-weather cab is used; all controls located for natural, convenient manipulation; planetary wheel drive, power assist steering, torque converter and fully automatic transmission; and 4-wheel hydraulic power booster brakes. Travel speeds are from 3 to 24 mph. A 6-cylinder gasoline engine, 363 cu. in. displacement and developing 105 hp at 2200 rpm is standard. For complete data write The Thew Shovel Co., Lorain, O., or circle **No. 6-20.**

Loader has a capacity of two cu. yds.



Generator for construction operations

Heavy Duty 2500-Watt Generator

A rugged, heavy duty 2500-watt DC portable generator is available from Master Vibrator. A 6-hp 4-cycle Wisconsin engine is direct connected to the compound wound generator. Special heat resistant valves in the engine provide longer engine life. Voltage is controlled by a hand rheostat and a rubber mounted voltmeter. The unit is available in either 13 amps at 115 volts or 6.5 amps at 230 volts. It is rated at 2500 watts intermittent duty and 1500 watts continuous duty. For more data write Master Vibrator Co., 266 Stanley Ave., Dayton 1, O., or circle **No. 6-21** on the reply card.

Hi-Way Bituminous Paver

Paver can be operated in tight places

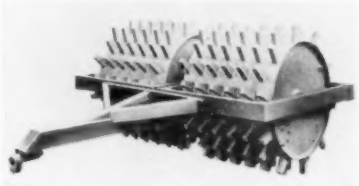
The Model "AS" is a fast worker on driveways, parking lots, playgrounds, airports, streets, roads and highways. Available in 8, 9 and 10-ft. widths, with capacities up to 1 1/3 cu. yds., the paver is an ideal running mate for most self-propelled equipment. Its size permits paving anywhere a truck can drive. A completely adjustable, full-floating screed permits concave or convex surfaces up to 1½-in. crown to eliminate much of the hand labor necessary to prepare a base course. The versatile paver can be equipped with an optional heated screed to pave both hot and cold mixes. Complete information from Highway Equipment Co., Dept. H41-3, 616 D Ave., N. W., Cedar Rapids, Ia., or circle **No. 6-22** on the reply card.

Document Printer

The Univac Solid-State document printer, an electronic printing unit to compute, edit, punch, print on both sides and segregate any standard tabulating-sized documents in a single operation is announced by Remington Rand. The new printer is designed to eliminate manual and peripheral machine operations otherwise necessary to complete large-scale computer processing. Ordinarily, when basic computer programming is completed, the resulting magnetic tape must go through several stages before the final documents can be printed out. Now, the tape can be fed directly into the printer, and all final printing steps are handled automatically at high speed. Cards can be fully processed, in a single pass through the printer, at speeds up to 1,456 lines per minute, and as many as 1,820 characters of information can be printed on one card. More data from Remington Rand, Div. of Sperry Rand Corp., 315 Fourth Ave., New York 10, N. Y., or circle **No. 6-23** on the reply card.

New Design Tamping Roller

A new tamping roller, the Model 170, is announced by Koehring Company of California. Tamping feet of the roller are shaped to penetrate and withdraw from loose fill with a minimum of disturbance of the fill material and to clean readily when working in sticky material. This feature reduces drawbar pull and results in faster compaction. Each of the two roller drums has 20 rows of tamping feet, six per row, or a combined total of 240 feet on both rolls. Pressure on tamping feet when drums are empty is 207 psi.; when 75 percent filled with water, 298 psi.; and with drums 75 percent filled with sand and water, 373 psi. Drums empty weigh 17,150 lbs.; with water, 24,650 lbs.; and with sand and water, 30,-680 lbs. Overall working width of drums is 11 ft. 1 in. Complete data from Koehring California Co., Div. of Koehring Co., 2200 Country Club Blvd., Stockton 4, Calif., or circle **No. 6-24** on the reply card.



Roller has a total of 240 tamping feet

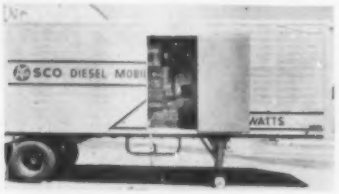
New Davis Model 220 Backhoe Has Hydra-Slide Positioning

The new Davis 220 backhoe, with Hydra-slide, which operates in any one of five digging positions, is announced by Massey-Ferguson. New improvements include increased operating pressure to 2,150 psi, larger bucket cylinder for 50 percent faster dumping, and a greater breakaway power up to 14,000 lbs. The unit makes it possible for one man to move the entire digging assembly along the frame to any of the five positions in less than five minutes. The operator's seat and controls move right along with the digging assembly, so the operator is always in line with his work. The Davis backhoe attaches directly to the Davis loader, and utilizes the same hydraulic system. For complete details write Massey-Ferguson Industrial Div., 1009 South West St., Wichita, Kan., or circle **No. 6-25** on the reply card.

Paint for Water Tank Interiors

Tropical Paint Company's Zincoater is a zinc dust pigment that sticks tightly to the metal, giving years of protection. It is safe to use in tanks containing potable water, or water that is used in manufacturing processes. It also stops the spread of any traces of rust that have been trapped under the paint. The zinc dust in the paint acts as an anode, while the steel acts as a cathode, thus forming a galvanic cell. If the painted surface is injured, exposing the metal to moisture, the zinc dust paint gives sacrifical protection. It will go into solution rather than the exposed metal. For further information write to Tropical Paint Co., Cleveland 2, Ohio, or circle **No. 6-26** on the reply card.

Diesel-Electric power plant on wheels



Uninterrupted power under emergency conditions is now being assured throughout the state of Nebraska by operation of two power plants on wheels. Assembled as a full trailer unit, the plants are used during change-over of lines and sub-stations and during emergency weather conditions. Each unit contains a General Motors 450hp model 8-268A diesel engine and a Westinghouse 300kw, 375-kva electric generator complete with switchgear and radiator.

300kw power plants on wheels, manufactured by A. G. Schoonmaker Company, are available for immediate delivery and arrive ready to operate on all power requirements.

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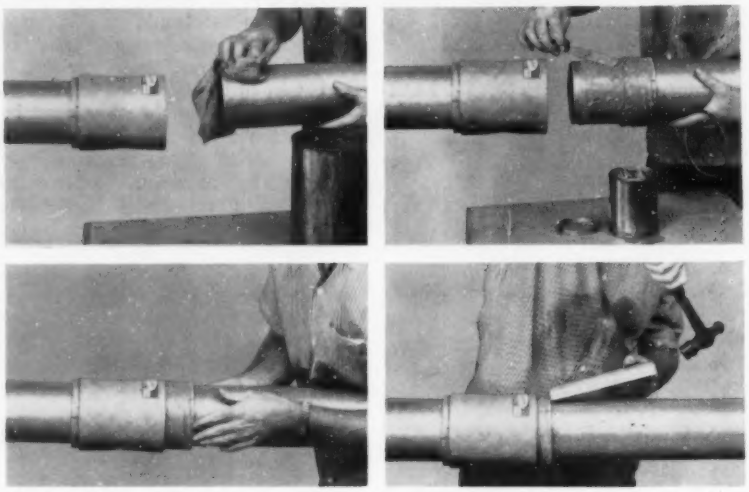
ORDER from Book Department, PUBLIC WORKS, 200 So. Broad St., Ridgewood, N. J. Only $1.00 per copy.

Corrosion-Resistant Fittings for Plastic Pipe

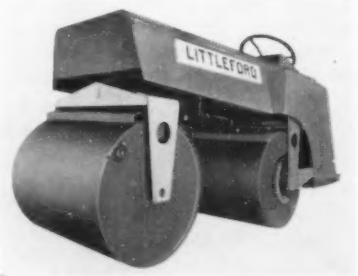


Plastic pipe can be used for sewage pumping and aeration lines and for water lines

Water and sewage engineers are expected to find many applications for Bondstrand reinforced plastic pipe now that a large range of fittings is available from Amercoat. Many municipal groups are studying the epoxy-and-fiberglass pipe for sewage pumping and aeration lines, vent lines subject to sewer gases, and water lines for difficult soil conditions. The new fittings include 90° and 45° elbows, tees, couplings and other fittings for either threaded-end or plain-end Bondstrand pipe. Bondstrand plastic pipe comes in rigid 20-ft. lengths in 2 to 8-in. diameters. The pipe is easily cut and joined in the field and requires no special tools. Most joints are currently made with a locking wedge and an O-ring, and secured by a special adhesive which seals the joint permanently against leakage. The second method now in use employs threaded Bondstrand pipe and fittings, sealed against leakage by a special thread compound. Details from Amercoat Corp., 4809 Firestone Blvd., South Gate, Calif., or circle **No. 6-27.**

Smooth-Topper One-Ton Roller

Littleford announces the newest addition to their line of portable tandem type rollers with the introduction of their Model 125 "Smooth-Topper" one-ton roller. Outstanding features of the roller include the ease of maneuverability and the time saving operator's platform. The operator's platform eliminates the need to climb down, over or through the roller and permits quick access to tools. For complete information write Littleford Bros., Inc., 457 E. Pearl Street, Cincinnati 2, Ohio, or circle **No. 6-28** on the reply card.



Operator's platform eliminates need to climb down or through the roller

Homelite Mower Car

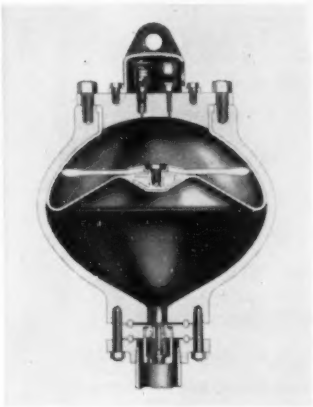
A ride-on lawn mower, the Homelite mower car, has been announced by Homelite. The 26-in. rotary has the Powerdisc transmission, with three forward speed ranges plus neutral and reverse, operates just like the automatic transmission of a car. The 6-hp engine gives additional power for climbing extra-steep hills or cutting extra-heavy weeds. The pivoted front axle gives sure control on sharp turns and also more comfortable riding qualities. A full line of attachments is featured for year around utility, including a leaf mulcher, roller, seeder, aerator, snow plow and gang reel mower. Further information from Homelite, Port Chester, N. Y., or circle **No. 6-29** on the reply card.

New Model Five-Ton Roller

The Model 560, a new 3½ to 5½-ton tandem roller featuring either an air cooled or water cooled engine, is announced by Essick Mfg. The 5½-ton roller is available in two models: The 560-C with Continental water cooled engine developing 32 hp is 4-cylinder in line type; or the 560 with Wisconsin V-type air cooled engine developing 30 hp. Maximum working weight has been increased to 11,300 lbs. on the air cooled model, and 11,500 lbs. on the water cooled model. Dual controls and two locations for the adjustable height operator's swivel seat make it possible to operate the roller from either side providing full visibility at all times. For more data write Essick Mfg. Co., 1950 Santa Fe Ave., Los Angeles 21, Calif., or circle **No. 6-30** on the reply card.

Surge Absorber for Fluid-Handling Lines

For control of line surges and pulsations due to the action of reciprocating pumps or the quick closing of valves, Hydril Co. offers the Type "K" surge absorber. Adaptable to any fluid-handling system, this equipment is being successfully used in water pumping systems. It consists of a thick-walled surge chamber in which a nonwrinkling diaphragm floats on



Units come in a wide range of capacities and pressure ratings

the surface of fluid which enters from the line. Above the diaphragm, the chamber is precharged with gas to provide the pressure which forces the diaphragm downward to effect complete displacement of the fluid through the outlet. Detailed information is available from the Hydril Co., 714 W. Olympic Blvd., Los Angeles 15, Calif., or circle **No. 6-31** on the reply card.

CLASSIFIED ADVERTISING AND JOB OPPORTUNITIES

Sanitary Engineer Wanted

Sanitary Engineer is wanted for department head of established firm in Midwest. Prefer age between 35 and 55. Applicant should have had responsibility of design of sewage and water treatment plant. Salary five figures with fringe benefits.

Write to:
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Civil Engineer Available

Thirty years experience in highway and municipal construction and maintenance. Five years of which as general manager for contracting firm. Past seven years as County Manager of large county in southeast, which position am now holding. Desire to make change and will consider position as City or County Manager or executive position with contracting firm. Present employer may be contacted for reference if negotiations warrant.

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Established Manufacturers' Representative Desires Additional Account

An established manufacturers' representative, now operating successfully in the New York City, Northern New Jersey, Western Connecticut, and Eastern New York area, desires an additional account, preferably for sluice gates, valves or similar equipment. He now handles sanitary engineering equipment in this area, and has excellent contacts with principal consulting engineers. He is well known to, and highly recommended by, The Editor of Public Works.

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Public Works Magazine
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FOR SALE

Sewage plant to be abandoned at Fairborn, Ohio. Must be removed from site. Parties interested in any salvagable equipment write to:

Western Contracting Corp.
Box 306, Fairborn, Ohio

Rotary Cutter Distributorships Open

Desirable protected territories available for Covington Brush Cutters, a new and improved line for heavy-duty work. Rugged construction and safety features make Covington Cutters ideal for land clearing and right-of-way cutting. Made by the manufacturer of Covington Planters since 1912.

For literature and details, write:
W. F. Covington Planter Co.
Dothan, Alabama

PROFESSIONAL OPPORTUNITY

The Department of Sanitary Engineering of the District of Columbia is accepting applications for the positions of Sewage Treatment Plant Shift Superintendents.

Desired qualifications include college degree in sanitary or civil engineering and previous experience in sewage treatment plant operation. The starting salaries for these positions are $4,490 to $7,510, depending on experience.

This is a Civil Service position as a Shift Superintendent in a high-rate activated sludge treatment plant of a design capacity of 290 mgd. Benefits include paid annual leave and sick leave, group insurance, retirement and other employee benefits.

Those interested may send a complete summary of education, experience and personal data to Mr. Hugh A. Schreiber, Superintendent, D. C. Sewage Treatment Plant, 5000 Overlook Avenue, S. W. Washington 24, D. C.

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PUBLIC WORKS JOURNAL CORP.

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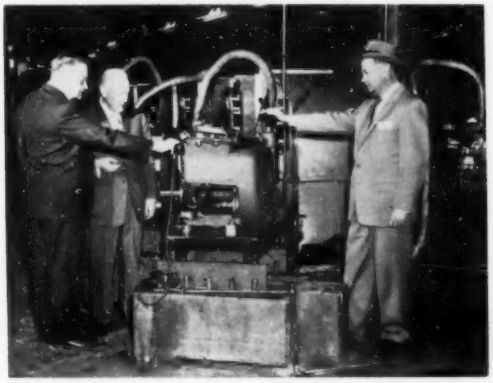
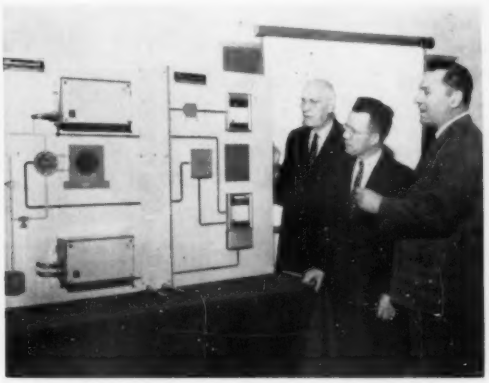
WORTH SEEING

In Texas, working hard to get water! The world's largest ditcher, a Gar Wood-Buckeye 330 owned by the Cameron County Water Board digs a system of irrigation canals which are later lined with concrete. This 55-ton machine will excavate up to 800 cy./hour.

In Ohio, too much water! Three "Michigan" rubber tired tractor shovels owned by the City of Canton served as a "bucket brigade" as they waded from house to house through flood water to scoop up residents.



3,000,001st air-cooled engine being readied for dynamometer tests as the Wisconsin Motor Corp. starts its "second half century of engine progress." Shown here (left to right) are plant superintendent A. J. Brown, Pres. H. A. Todd and Sales Mgr. R. J. Fellows.



New remote control instrumentation developed by Minneapolis-Honeywell is shown to W. W. DeBerard, deputy commissioner and chief engineer of Chicago's Dep't. of Water & Sewers and G. S. Salters, chief filtration engineer by an M-H representative.

Home of Walker Process Equipment Inc. in Aurora, Illinois, where 13,000 square feet of manufacturing area was added recently to provide more capacity.

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Smith & Loveless offer the low-cost "Oxigest" Sewage Treatment Plant that has been carefully engineered for dependable treatment without requiring a skilled operator. The "Oxigest" is built of the finest materials and will provide a permanent plant with minimum annual maintenance.

This complete factory-built unit is available in 27 standard sizes to cover a wide range of applications. It is easily and quickly installed after delivery to the job site on special Smith & Loveless trucks.

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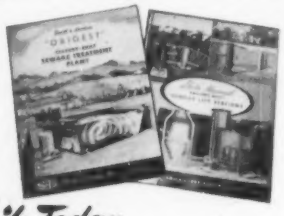

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Design notes, selection charts, dimension drawings, specifications and a list of representative installations for the "Oxigest" and lift stations.

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by Arthur K. Akers

★ **Joseph A. Leadabrand** succeeds **Thomas E. Long**, now Eastern Regional manager, as assistant to the vice president for promotion, Portland Cement Association.

★ **W. E. Galland** occupies the newly created position of market development manager for WEMCO, a Division of Western Machinery Co., San Francisco.

★ **James A. Main** will manage the newly alined Industrial Division of the Flintkote Co., handling the sales of paving products.

★ Nordberg Mfg. Co.'s Engine Division names **Carroll E. Dietle** as general sales manager.

★ **Jack W. Pratt** is announced as eastern sales manager, Process Engineers Inc., Division of The Eimco Corporation, headquartering at the Eimco-Process Research and Develcpment Center at Palatine, Ill.

Mr. Pratt

Mr. Toneman

★ **Paul A. Toneman Sr.** is named Government Relations Manager of National Clay Pipe Manufacturers Association Inc., in Washington, D. C. He will head up all government relations for the Association and its 41 member companies.

★ B-I-F Industries, Inc., Providence, R. I., names **Edward C. Ross** as assistant advertising manager.

★ **Willis ("Bill") R. Howe** is promoted to sales manager, Sherman Products, Inc., Royal Oak, Mich.

★ **Thomas F. Flood** becomes executive vice-president, The Galion Iron Works and Mfg. Co., Galion, Ohio. He was a vice-president of the Frank G. Hough Co.

★ **José A. Vilá,** chief engineer of Cuba's municipal water and sewage administration, has been in the United States attending the Sewage Treatment Practice School conducted annually by Yeomans Brothers Company in suburban Chicago.

Mr. Vilá

★ Cushman Motors, Lincoln, Neb., announces creation of additional executive positions and doubling of sales force and advertising.

★ **James E. Gleason** becomes assistant sales manager, Conveyor Division, Barber-Greene Company, as part of a major expansion.

★ Warren Pumps names **Edward H. Elliott** industrial sales representative in the area centering in Baltimore.

★ **Charles W. Krause** is promoted to general sales manager, liquid meters, for Neptune Meter Co., New York. **James C. Judge** succeeds him as eastern regional sales manager.

★ Jeffrey Mfg. Co., Columbus, Ohio, announces a number of personnel changes in the course of realining its field office operations. Jeffrey is best known in this field for its water and sewage treatment equipment.

★ General Electric Co. has concentrated its Communication and Technical Products Departments at Lynchburg, Va., with **Harrison Van Aken** as general manager.

★ **Tom Barney** becomes general sales manager, Pfaff & Kendall, manufacturers of street and highway lighting standards and traffic signal and sign supports.

★ Classified ad by the Water Works in a small college town: "Wanted: Hard-boiled, beauty-proof man to read meters in sorority houses. We haven't made a dollar there in two years."

—Huber Warco News

. . . familiar **HIGH SIGN**

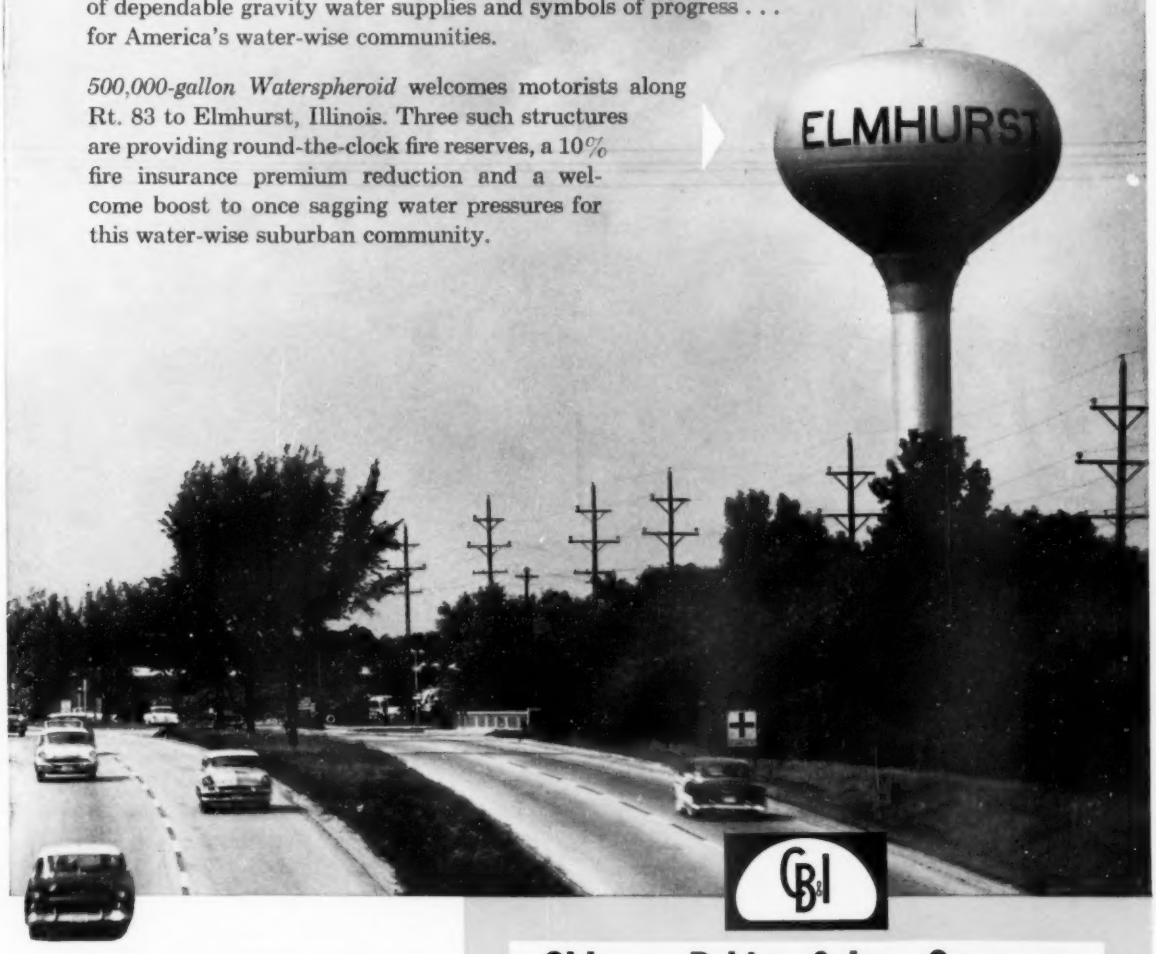
of the progressive community

Horton Waterspheres® and Waterspheroids® now grace the skyline over hundreds of progressive communities because they meet today's municipal standards for dependable performance and ease of maintenance . . . in a handsome, functional "package".

The all-welded structures require little ground space for foundations and bases can be used for pumping or storage. They are easy to paint and maintain . . . and their *modern designs* meet the aesthetic standards of *modern communities.*

Waterspheres and Waterspheroids have become landmarks of dependable gravity water supplies and symbols of progress . . . for America's water-wise communities.

500,000-gallon Waterspheroid welcomes motorists along Rt. 83 to Elmhurst, Illinois. Three such structures are providing round-the-clock fire reserves, a 10% fire insurance premium reduction and a welcome boost to once sagging water pressures for this water-wise suburban community.



Waterspheroids are built in capacities of 250,000 to 500,000 gallons. *Waterspheres* serve in range of 25,000 to 250,000 gallons. Write the nearest CB&I office for literature.

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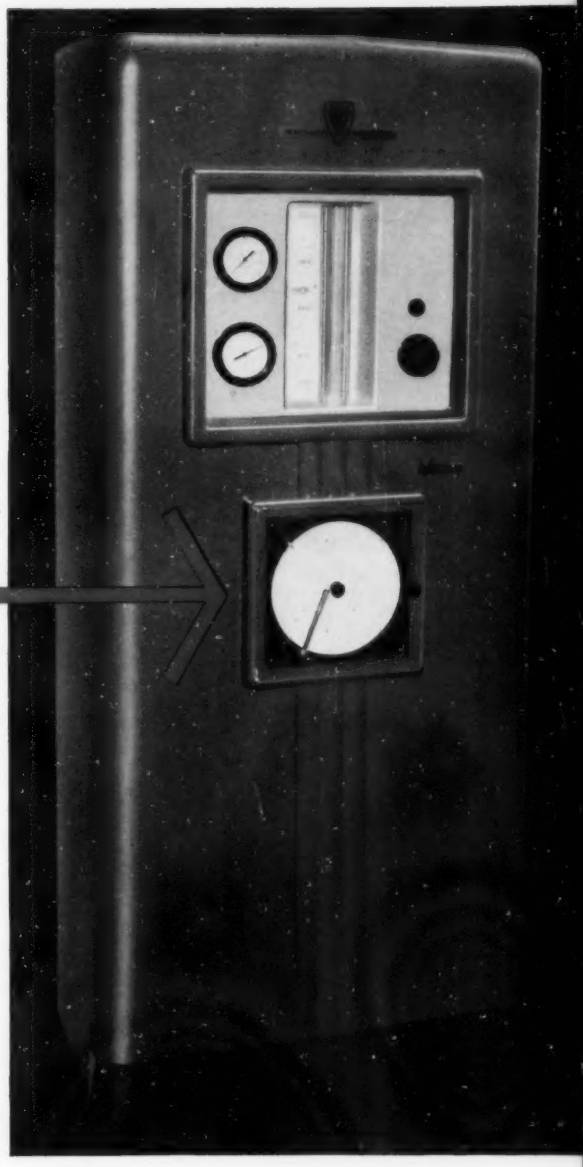

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This reliable recorder is designed for use with most V-notch Chlorinators. Its effective mechanical operation, made possible by the simplicity of the V-notch Variable-Orifice, assures an accurate record of chlorine flow.

The A-733's linear charts, calibrated to match the rotameter, have equally spaced graduations for easy reading. The charts provide permanent records useful to check the operation of equipment or the amount of chlorine fed during unattended periods. With the A-733, containers can't run dry: You know chlorine consumption to the pound.

An optional vacuum switch warns of any interruption of chlorine flow. It moves the recording pen to a check line and actuates an accessory alarm.

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